MACHINERY

DECEMBER 20, 1961 ONE SHILLING & THREEPENCE

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the season's greetings from SKF

THE SKEFKO BALL BEARING COMPANY LIMITED LUTON · BEDS

Clamp Down on Your Jig and Fixture Costs with—

Speetog Clamps

REGD. TRADE MARK

To ensure economic output, work loading and fixing times must be cut to the minimum in all production operations, but at the same time accuracy and efficiency must be maintained.

Much depends on the design of jigs and fixtures and most designers now regularly specify "Speetogs" wherever instantaneous clamping and release of the job is required. As standard units for immediate incorporation into jigs and fixtures "Speetogs" are unequalled and for years now we have regularly supplied them from stock.

There is a "SPEETOG" clamp for every purpose.

Write for details of our ever growing range.

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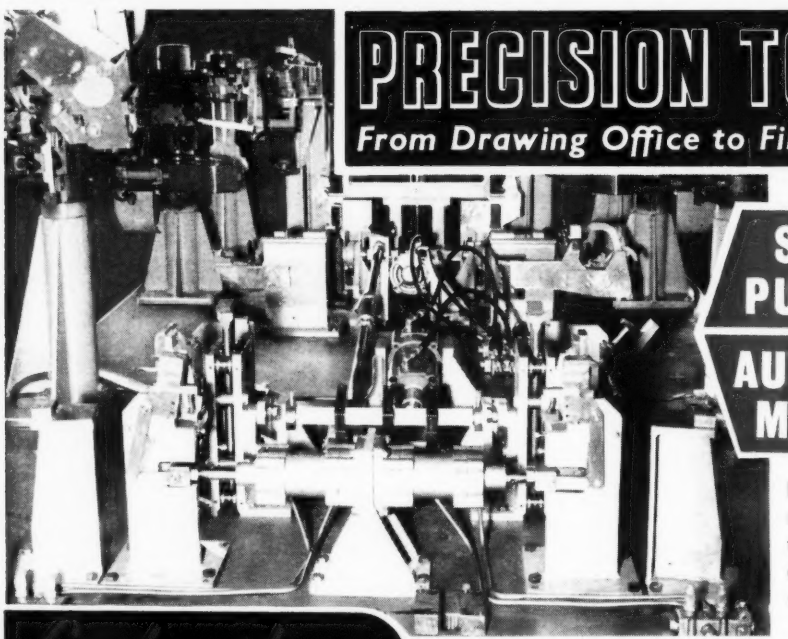
VEREKER HOUSE, GRESSE ST., LONDON W.1. Museum 1039/1099.

NRP 9080



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"These Wild-Barfield furnaces do a really good job"

Where heat-treatment is concerned—are you doing the job as economically as possible? It's surprising the number of people who invest in expensive machine tools for production—and then spoil a good job in outdated furnaces. And the result? Rejects—time, money and probably customer goodwill lost. More and more people are relying on Wild-Barfield equipment. Write for full details and see how you can save by changing to modern electric furnaces.

Self-contained Electrode Salt Bath ESB 346.
Standard Model delivery ex stocks

WILD BARFIELD

ELECTRIC FURNACES
FOR ALL HEAT TREATMENT PURPOSES
Backed by 40 years specialist experience

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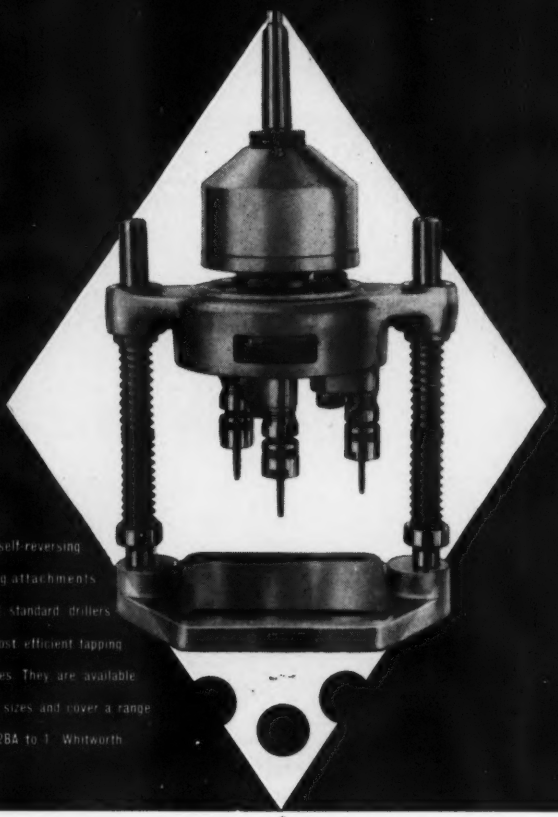
A

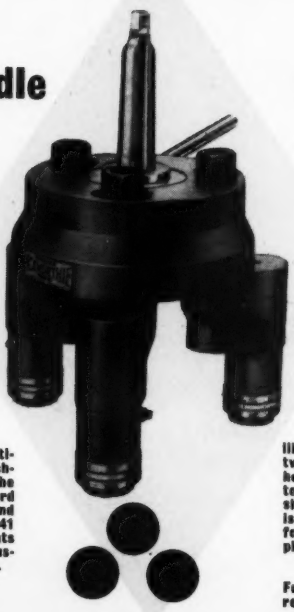
Tapping Attachments

Self-reversing multi-spindle tapping attachments are supplied with two, three or four adjustable spindles. They are available in two sizes and cover a range from ½" minimum centres to 5" maximum pitch circle diameter. Max. capacity ⅜" Whitworth.

These self-reversing tapping attachments convert standard drillers into most efficient tapping machines. They are available in four sizes and cover a range from 12BA to 1" Whitworth.



Multi-Spindle Drilling Attachments



Adjustable centre multi-spindle drilling attachments increase the productivity of standard drilling machines, and we have a range of 41 standard attachments available to meet customers' requirements.

Illustrated are Fig. 199 two and three spindle heads with spindles bored to take No. 1 morse taper shank drills. This model is also available with four spindles, maximum pitch circle diameter 6½".

Further details on request.

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DALEHOUSE LANE, KENILWORTH, WARWICKSHIRE

PHONE: KENILWORTH 1530 P.B.X.

GRAMS: "ACKWORTHIE, KENILWORTH"

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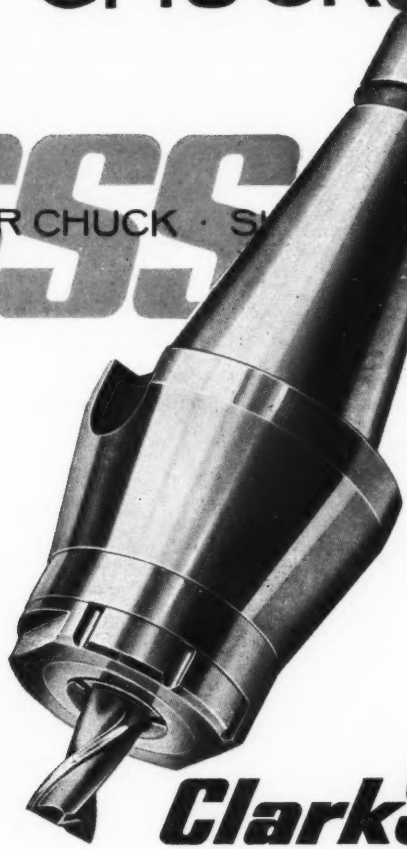
SUPER CHUCK · SUPER CHUCK · SUPER CHUCK



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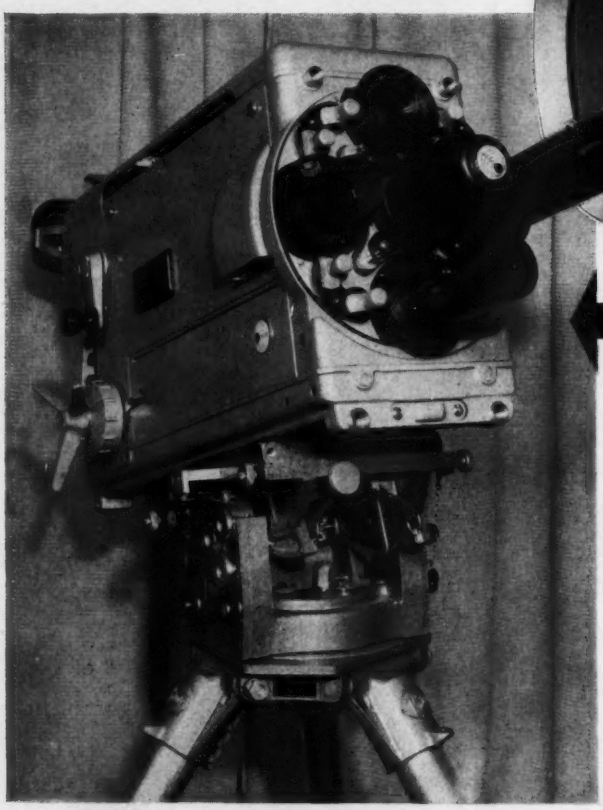
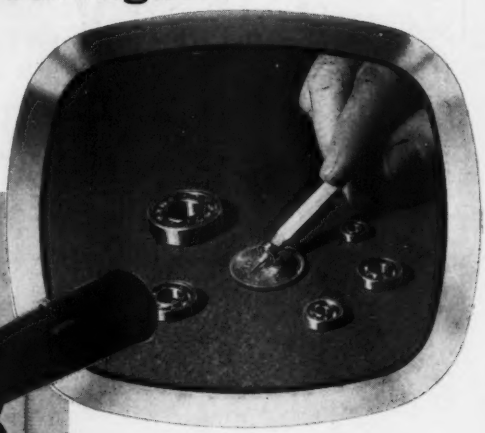
HOFFMANN

instrument bearings... fitted exclusively to THE MARCONI MARK IV TELEVISION CAMERA





NEW ADVANCE

Sensitivity, stability, consistency, and reliability—all are qualities of the new Marconi Mark IV television camera based upon a 4½ inch image orthicon pick-up tube.

The Marconi Mark IV has an exceptionally good performance under either natural or artificial light, and such high stability of circuitry that a consistently high quality picture can be held without frequent re-adjustment of controls. In the B.B.C. Studio Number Three, the vision control officer is responsible for the controls of up to six Mark IV cameras. Obviously, each and all of these must be unfailingly consistent in optical and electrical performance. Equally their mechanisms must respond smoothly and instantaneously to the requirements of control. Here fourteen Hoffmann bearings play their part, ranging from $\frac{3}{16}$ to $\frac{1}{4}$ of an inch bore.

They are depended upon to give ease and smoothness of movement in such vital components as the Turret Mechanism, the Focusing Mechanism, and the Remote Iris Mechanism and Filter Kit.

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BRANCH OFFICES AND STOCKROOMS IN ALL PRINCIPAL TOWNS

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WORM REDUCTION DRIVE PLANING MACHINE

At last!
-- a low priced machine with a high priced machine's performance

- This powerful and productive machine has a wide speed range adequately covering all [illegible] requirements. Simplicity of operation has received special attention, and all controls are within easy reach of the operator.
- Lubrication is [illegible] efficient, the motor driven [illegible] continuously flooding the table ways, thus helping to ensure lasting accuracy.

planers
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Multi-channel oscillograms being made of the performance under load of a Cowlishaw Walker steel frame eccentric press at the Manchester Works of Associated Electrical Industries Ltd. This meticulous graphical analysis of the performance of this new range of eccentric presses of advanced design guarantees to the user:— higher productivity, better pressings and longer tool life.

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UNIT CONSTRUCTION MAKES AIR VALVES
MORE VERSATILE
EASIER TO SERVICE
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BY HAND
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for SUSTAINED efficiency

Here is an important addition to our range of Pneumatic control gear which brings automation right within the grasp of your engineers.

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Designers and engineers are invited to send for our comprehensive catalogues.

DELIVERY NOW

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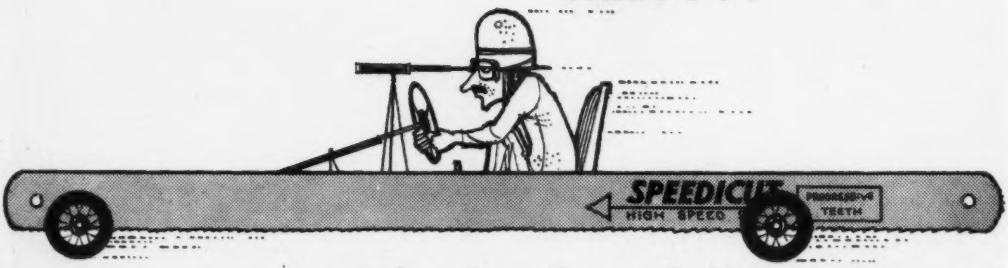
The easy starting blade . . .



. . . with the fast follow through

With the pitch of teeth progressing from 29 to 18 per inch along its length, this blade takes advantage of the natural sawing action. The fine pitch lead-in reduces the effort required and minimises breakage, so often met when blades of incorrect pitch are being used. Supplied in SPEEDICUT High Speed Steel and DIE-HARD Alloy Steel in 10″ and 12″ sizes at the same price as normal blades.

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PROGRESSIVE TEETH HACKSAW BLADES

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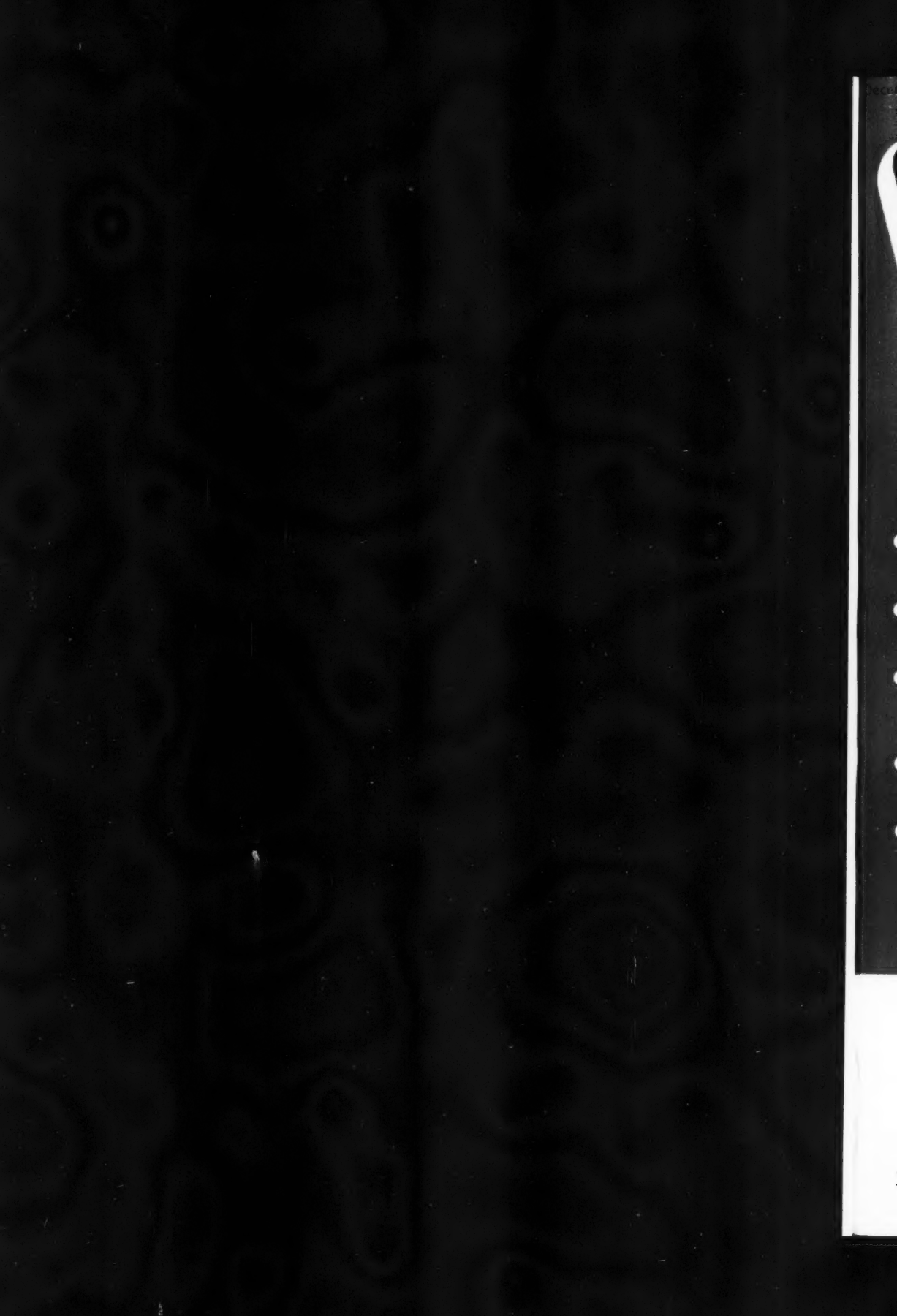
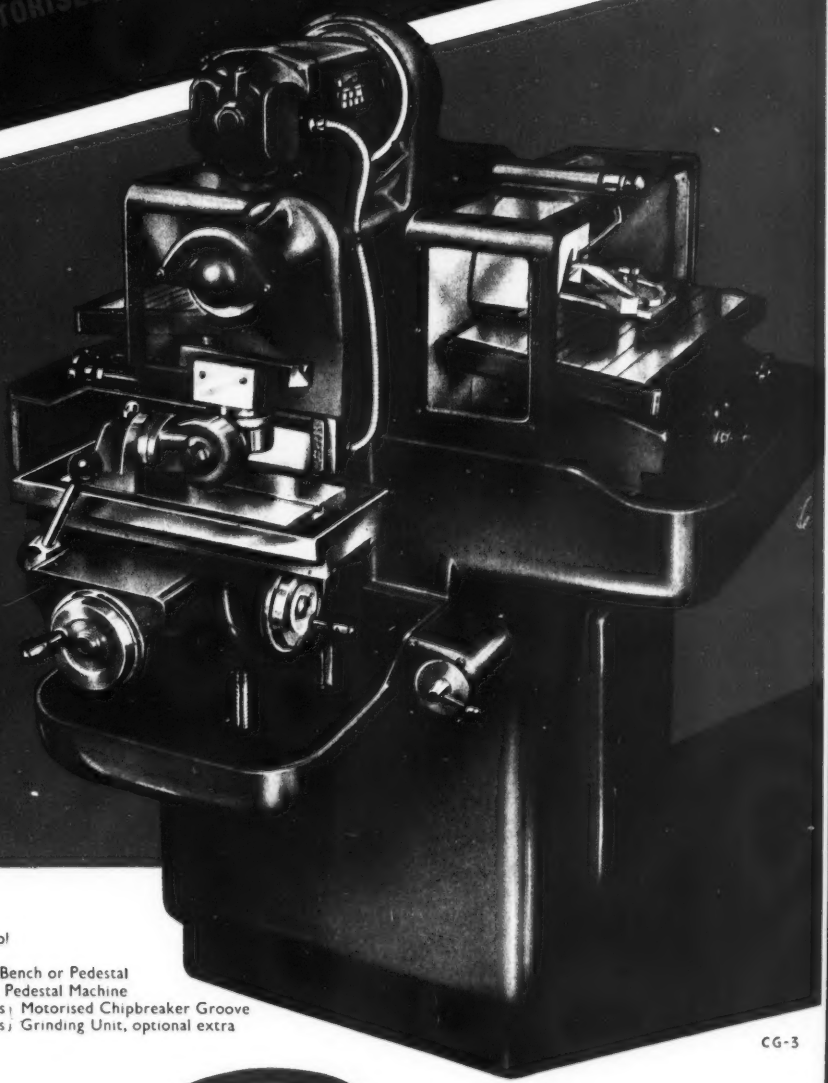
SPEEDICUT WORKS · CARLISLE ST. EAST · SHEFFIELD



ABWOOD 'CONCENTRE' CARBIDE TOOL GRINDER

WITH MOTORISED CHIP-BREAKER GROOVE GRINDING UNIT Model CG2A



- Constant centre height of table to grinding point irrespective of angle
- Adjustable taper roller bearings eliminate end float
- Perspex panelled spray guards provide perfect vision, hinged for easy access to wheel
- Uses diamond wheels to their maximum efficiency
- The Chipbreaker Groove Grinding Unit accommodates turning tools of most shapes and sizes

Our full range of Carbide Tool Grinding Machines includes:
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Model CG1A, 8 in. Wheels, Pedestal Machine
Model CG2A, 8 in. Wheels } Motorised Chipbreaker Groove
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CG-3

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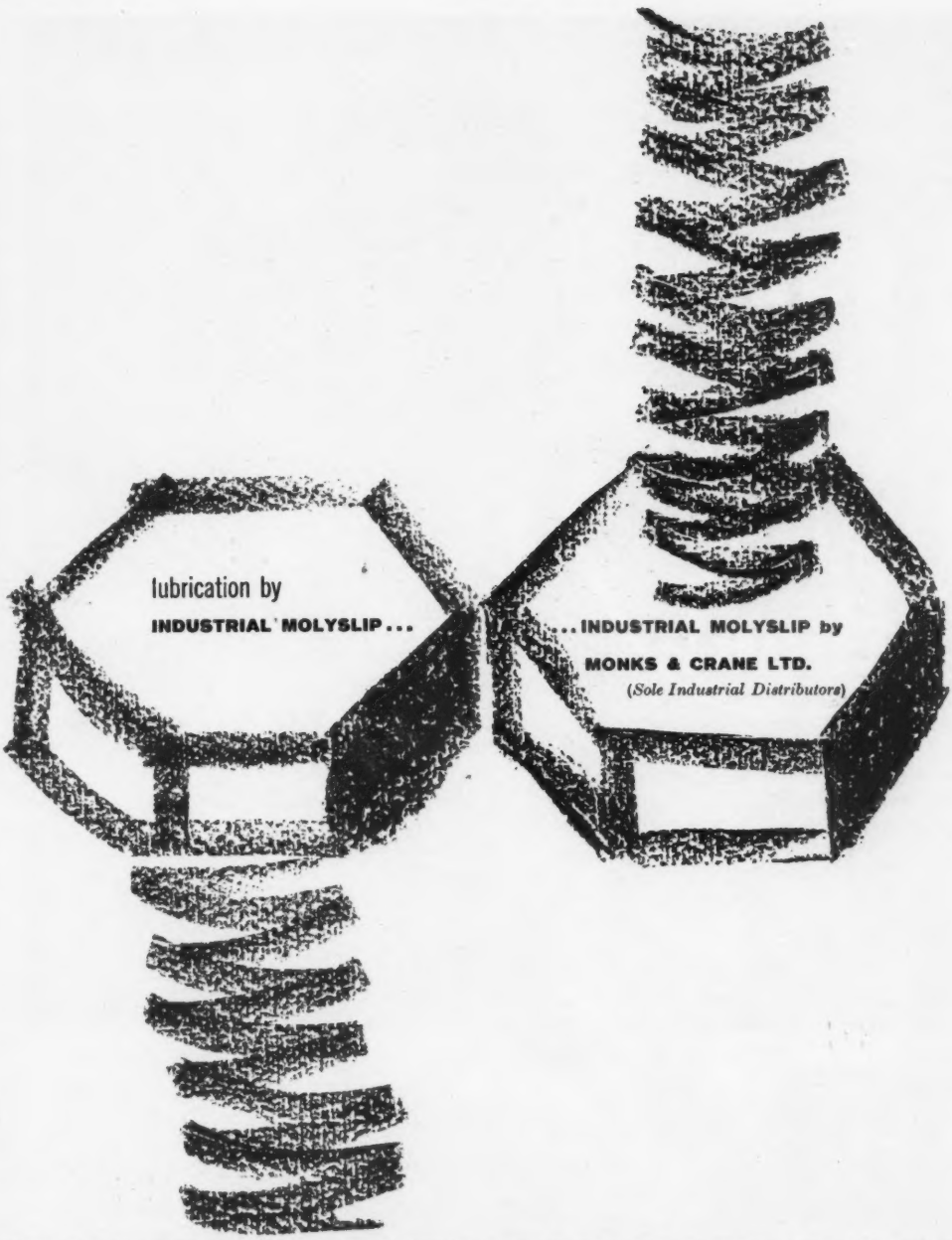

Molyslip is a product of **THE SLIP GROUP OF COMPANIES** 34, Great St. Helens, London, E.C.3. Tel.: AVEnue 1636. Telex: 23755.

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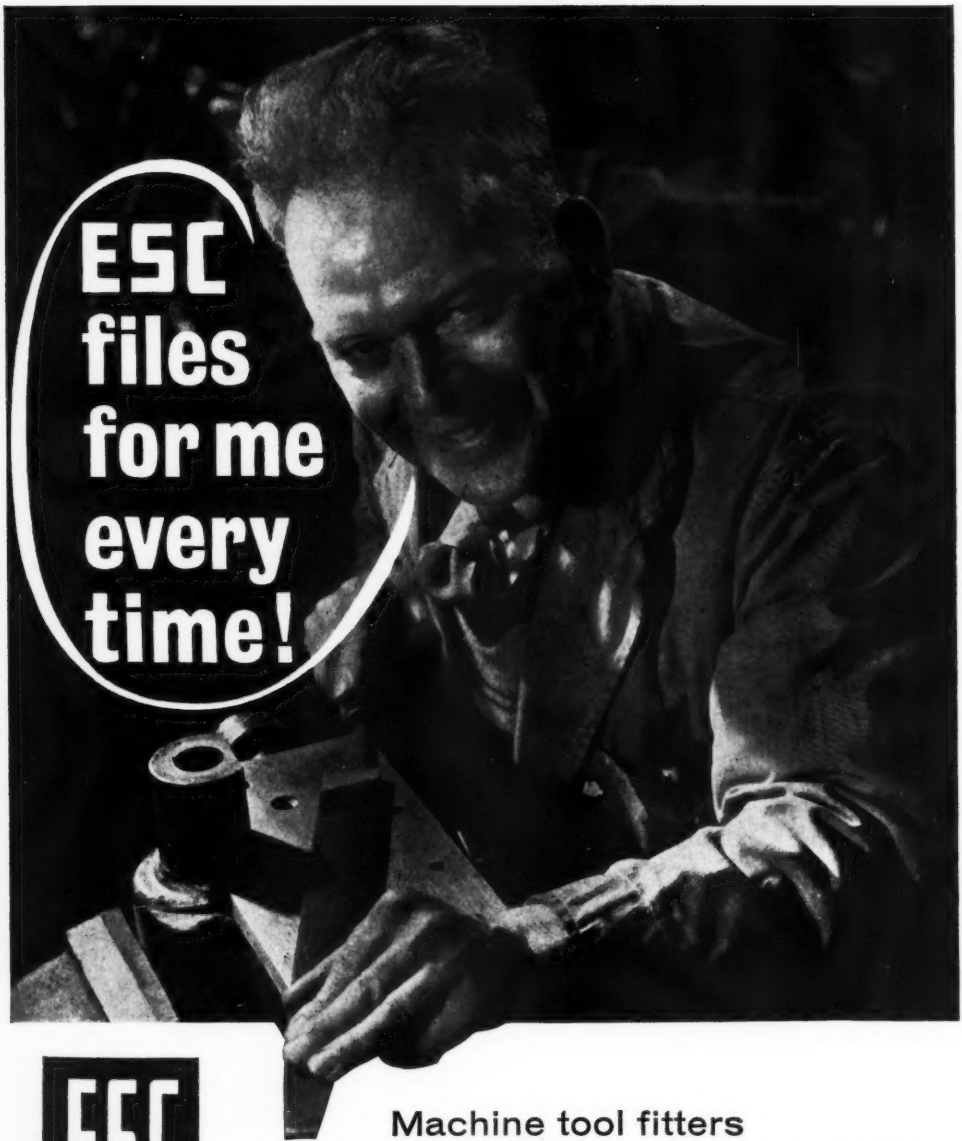

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From
DOWDING & DOLL LTD

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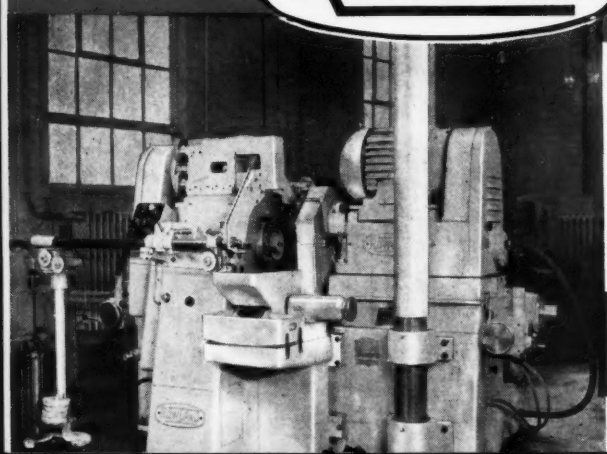

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This machine, recently installed in the works of Spirax-Sarco Ltd., is seen simultaneously grinding both faces of small circular components to exceptionally fine limits at extremely high rates of production.

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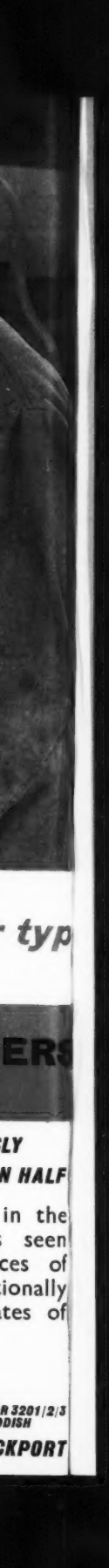

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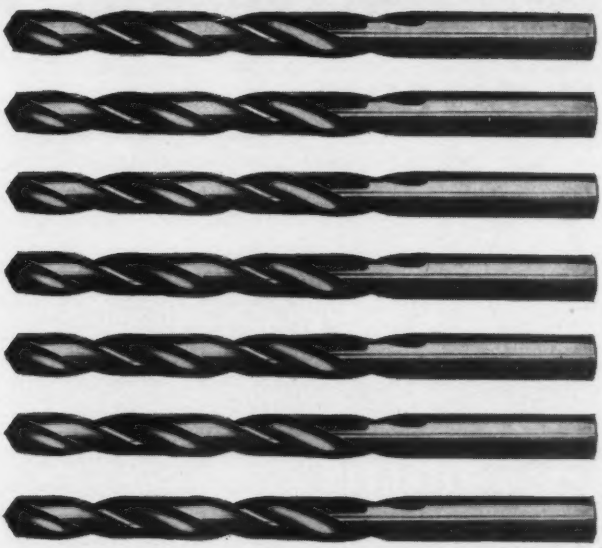

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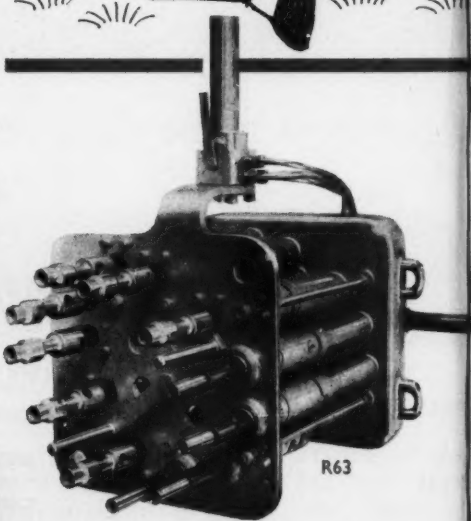
Today any operative can tighten nuts by the dozen. Thor Multi-spindle units can incorporate screwdrivers, studsetters, drills or impact wrenches. The latter are equally useful for dismantling.



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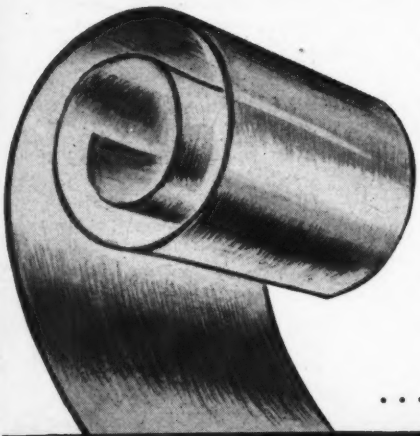

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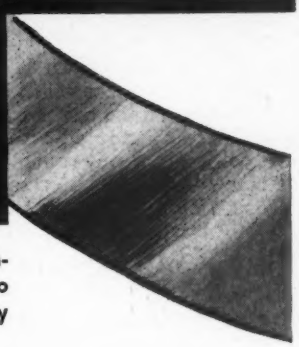

A battery of three Marbaix Model MP.25 Kleenall Combination Fabric and Magnetic Filters service the coolant for two Reversing Mills, effecting a marked improvement in the quality of the strip produced.

Pitting of the strip is eliminated and smut deposit on the strip no longer occurs.

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NRP 3602

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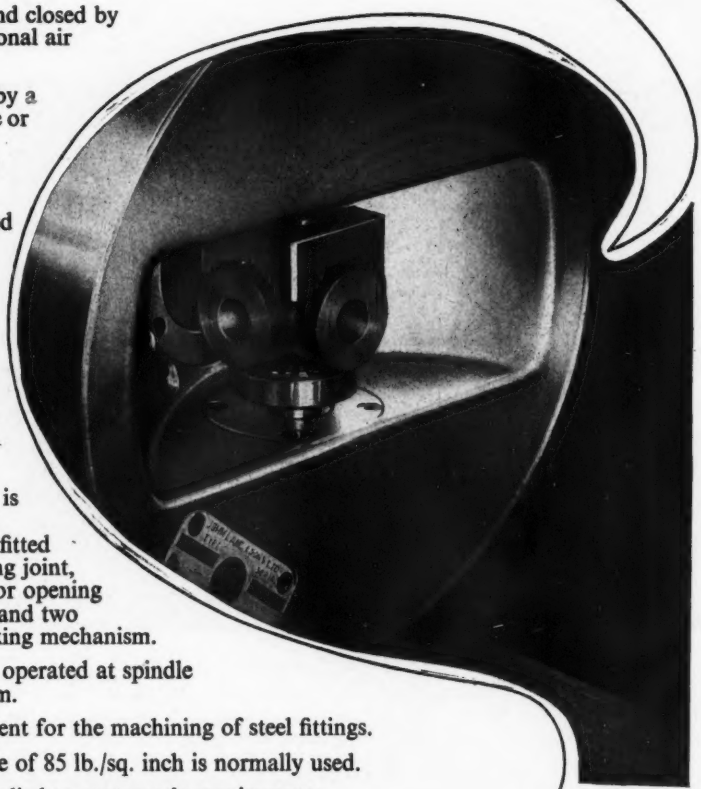
WITHOUT STOPPING THE MACHINE SPINDLE

CHUCKS CAN BE FITTED TO EXISTING MACHINES

LANG POWER CHUCKS



- The chuck is opened and closed by power as in a conventional air chuck.
- Indexing is controlled by a hand valve, a foot valve or a push-button valve operated automatically by the turret slide.
- The workpiece is indexed progressively in 90° steps.
- Indexing time is less than one second.
- Accuracy of index is within ·015" at a 12" radius.
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- The air cylinder which is carried on the back of the machine spindle is fitted with a four-way running joint, two leads being used for opening and closing the chuck and two for operating the indexing mechanism.
- The equipment can be operated at spindle speeds up to 1500 r.p.m.
- Gripping power sufficient for the machining of steel fittings.
- Works air line pressure of 85 lb./sq. inch is normally used.
- Valve gear will be supplied to customer's requirements.

LONDON OFFICE
ASSOCIATED BRITISH MACHINE TOOL MAKERS LIMITED
17 GROSVENOR GARDENS SW1

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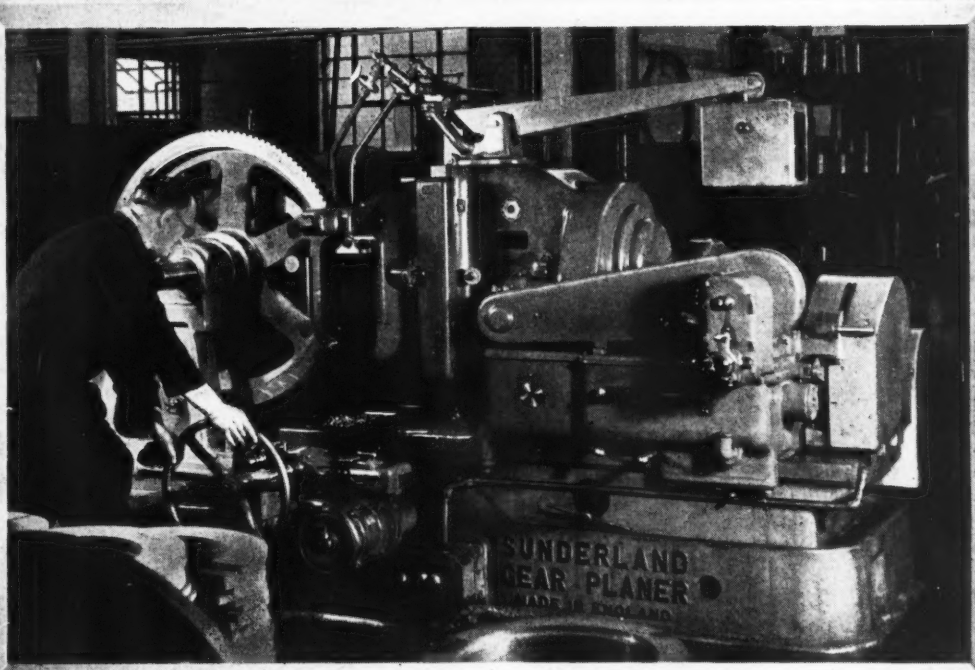
FOR SPUR, SPIRAL & DOUBLE HELICAL GEARS



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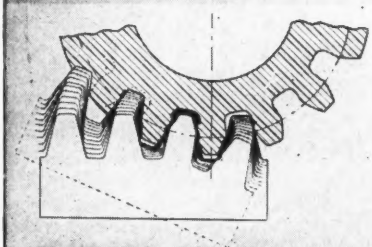

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- FEW CUTTERS AND GREAT RANGE AND CAPACITY.
- ONE CUTTER CUTS ANY NUMBER OF TEETH OF A PITCH.
- LOW INITIAL OUTLAY ON CUTTERS.
- LOW COST OF MAINTENANCE.

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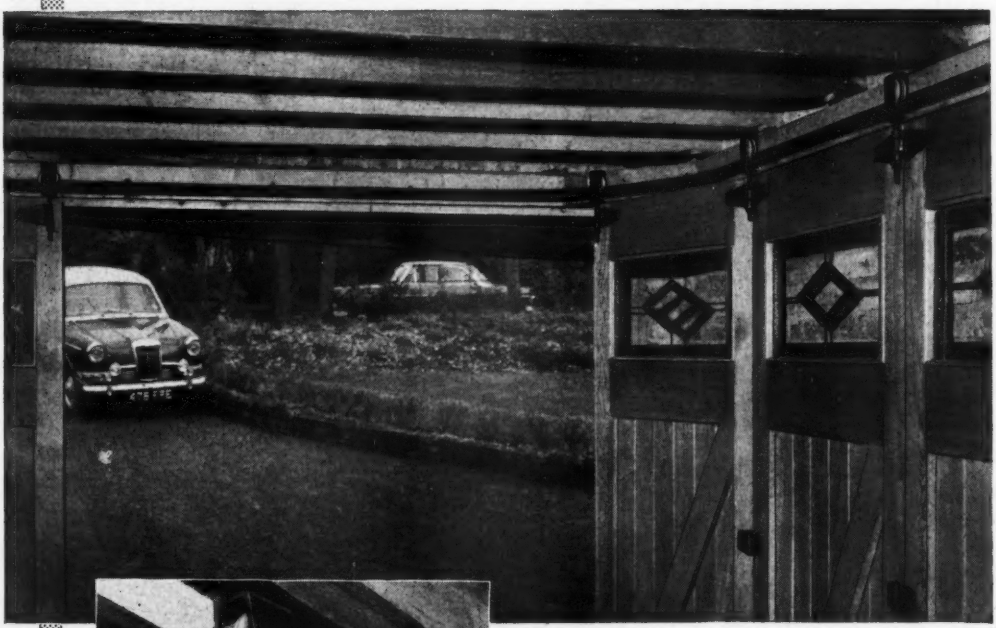
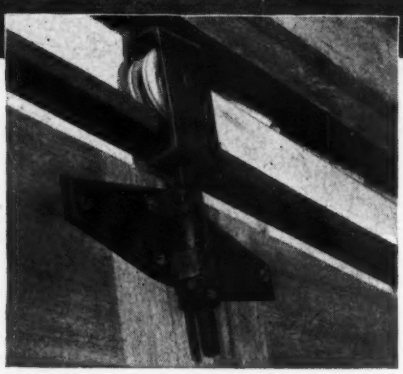
P363

B2





Garage sliding door with 'Cornaway' nylon 333 gear manufactured by Messrs. E. Hill Aldam & Co. Ltd., Britannic Works, Red Lion Road, Tolworth, Surbiton, Surrey. This gear incorporates '333' wheels moulded from 'Maranyl' I.C.I. nylon by Messrs. Punfield and Barstow (Mouldings) Ltd., Basil Works, Westmoreland Road, Queensbury, London, N.W.9.

'Maranyl' I.C.I. nylon takes the strain in silence on this garage door

This heavy garage door will always move easily and silently. The wheels on which each section hangs and the rollers that guide the base will not jam or squeal, cannot corrode and will not need lubrication. These wheels and rollers are part of the 'Cornaway' nylon 333 sliding door gear, and the reason for their remarkable efficiency is that they are made from 'Maranyl' I.C.I. nylon — as are so many moving parts throughout modern industry.

Apart from needing no lubrication and being tough, corrosion-resistant and noiseless in action, moving parts — and other components — made from 'Maranyl' are light in weight, resistant to oil, grease and vibrational fatigue, and have excellent insulation properties. 'Maranyl' can be moulded accurately into detailed components possessing a good surface finish, and is available in a wide range of colours.

I.C.I. Technical Service and Development

If you would like further information on the properties and uses of 'Maranyl' I.C.I. nylon, I.C.I. Plastics Division Technical Service and Development Department will be glad to help you.

'Maranyl'

'Maranyl' is the registered trade mark for the nylon compounds manufactured by I.C.I.

ICI

PN162

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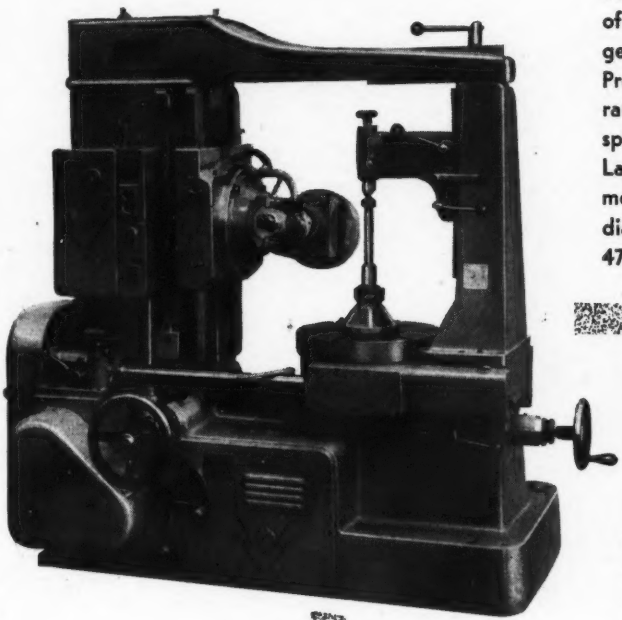
1 or 10,000 off

MMT

The Almhult KFI is designed for economic, precision hobbing of single, large or small batch gears.
Produces spurs, helicals, ratchet wheels, worms and splines.
Larger machine available, model KF2, maximum gear diameter that can be hobbed 47".



ÄLMHULT (SWEDISH) AUTOMATIC GEAR HOBBER KFI

* ECONOMIC
* ACCURATE
* VERSATILE

SPECIFICATION

Max. gear diameter that can be hobbed	23½"
Min. centre distance, cutter spindle-table	1¾"
Vertical travel of hob head slide	17 5/16"
Table diameter	19¾"
Table worm wheel indexing diameter ...	16"

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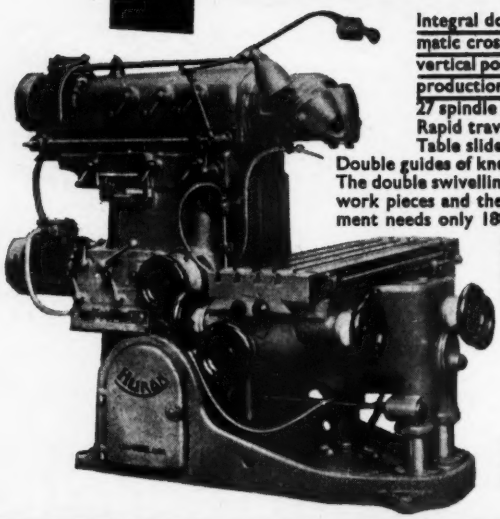
NRP 5155

SLIDING RAM GIVES 27½in. AUTO CROSS FEED

HEAVY DUTY MILLING

ANGULAR COMPOUND HORIZONTAL VERTICAL

HURON SUPER UNIVERSAL MILLERS



Integral double swivelling universal head provided with 27½in automatic cross feed by the sliding ram, can be set to the horizontal or vertical position, or to any angle instantaneously—permits the heaviest production cuts. Heads can be retracted completely from table line. 27 spindle speeds from 30 to 2,066 r.p.m., 27 feeds from ¼in. to 30in. Rapid traverses in all directions. All operating controls duplicated. Table slides directly in the knee without cross movement or swivel. Double guides of knee permit components in excess of 1½ tons to be machined. The double swivelling universal head requires an opening of only 14in. to enter work pieces and the whole sliding ram with its 27½in. automatic cross movement needs only 18in. clearance. OPTIONAL EXTRA FEATURES: Mounted spacing casting assemblies providing additional 8in. capacity under spindle. 26in. wide 8 T-slot tables and 39½in. automatic cross feed of sliding ram with special heavy duty knee and front operating position.

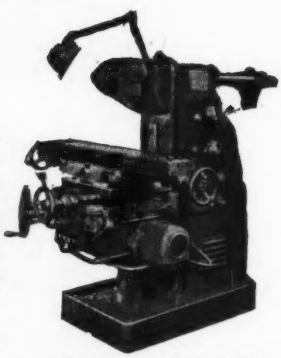
Type	Table	Automatic Feeds Long	Cross	Vert.
KU4	56½in. × 15½in.	43½in.	27½in.	19½in.
KU5	64½in. × 15½in.	51½in.	27½in.	19½in.
KU6	70½in. × 16½in.	59in.	27½in.	19½in.
KU55	64½in. × 26in.	51½in.	30½in.	18½in.
L83	157in. × 59in.	118in.	39½in.	59in.

HURON MU.6/FERRANTI 3-D MILLER

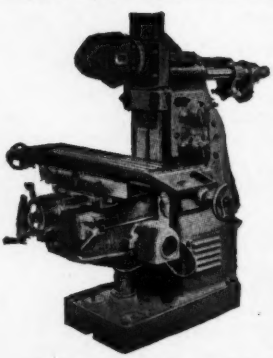
Type 'L' Open-side Traversing Head Universal Miller will mill, bore, slot and drill the largest work-pieces at one setting. The unique design permits greatest variety of operation on large work-pieces; the component remains stationary on the large work-table. Upright slides full length of base table and the sliding ram moves vertically and horizontally.

DUFOUR UNIVERSAL MILLERS

WITH DOUBLE UNIVERSAL SWIVELLING HEAD, RETRACTABLE SLIDE BRACKET AND SPACING CASTING GIVING 26" DAYLIGHT ON No. 59 AND 21" ON No. 61



FOR ALL MODELS Direct reading dial change for speeds and feeds. All parts subject to wear hardened and ground and completely interchangeable. Built to closest tolerances. Rapid traverses in all directions. Table swivels 30°. No. 40 taper for main horizontal spindle, double swivelling universal head, dividing head and rotary table. Hardened and ground centre guide for slideways. Twin overarms. Double swivelling sliding spindle heads with speeds 53-3000 r.p.m. Double swivelling universal head on retractable slide bracket providing with 5½in. Spacing Casting Drive assembly on 59 Machine 26in. daylight, and 21in. on No. 61.



MODELS 53 & 61. 16 universal head spindle speeds. 21-1600 r.p.m.; 8 horizontal spindle speeds 21-1180 r.p.m.; 8 automatic feeds ½-18½in.

MODEL 59. 36 universal head spindle speeds 14-1780 r.p.m.; 12 horizontal spindle speeds 21-1180 r.p.m.; 16 automatic feeds ½-20in.

MODEL 54. Automatic cross feed of universal head 20in.; 18 universal head spindle speeds 12-1500 r.p.m.; 36 horizontal spindle speeds 6-1500 r.p.m.; 18 automatic feeds ½-23½in.

Type	Table	Automatic Feeds Long.	Cross	Vert.
53	43½in. × 9½in.	27½in.	9½in.	15½in.
61	47½in. × 10½in.	30½in.	9½in.	15½in.
59	51½in. × 11½in.	34½in.	11⅜in.	21½in.
54	67in. × 14½in.	43½in.	14½in.	20½in.

Send for full particulars of our very extensive range of these machines; ask for demonstration.

Rudolph Carne & Co. Ltd. SWAN WORKS, FISHERS LANE, CHISWICK, LONDON, W.4.

Tel: CHISWICK 0514, 6585, 0337. Inland Telegrams: RUDCAR, CHISK, LONDON. Overseas Telegrams: RUDCAR, LONDON. W. 4.

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WITH FULLY AUTOMATIC DRILL *plus* PITCH CONTROLLED TAPPING

Quickly and easily set for drilling up to 2¼", tapping up to 2", reaming and spotfacing on 9" - 40" P.C.D. in flanges, rings, discs, etc. Provision for fully automatic control of spindle: rapid approach, drill feed, withdrawal, tapping feed, spindle reversal, table indexing or combinations of these with manual operation for any selected movements. 12 speed spindle in hydraulically actuated head with 18" traverse in which is mounted a quill-type drilling spindle with 12" traverse and infinitely variable feeds between ½" and 12"/min; rapid approach at 230"/min. and withdrawal at 470"/min; 36" dia. indexing table driven through worm gear by independent ½ H.P. motor. For full details, send for illustrated leaflet D.25.

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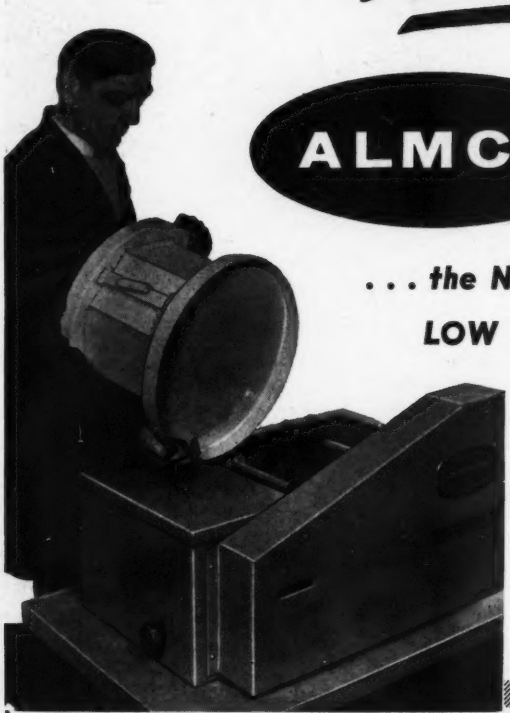
VERTICAL DRILLS

WITH AUTO-INDEXING ROTARY TABLE

BARREL FINISHING NOW within reach of the small user...



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Small in size, big in performance, that's the ALMCO Super Mite Barrel Deburring Unit. Ideal for research, production engineering departments and manufacturers with limited finishing needs.

ALMCO Super Mite

DBM.10 is especially intended for plants and departments processing small lots of parts. It speedily deburrs close tolerance components, producing a better finish, faster. Full information available.

COMPACT
26" high x 30" long x 18" wide; ½ cu. ft. capacity barrel with cam type door.

VERSATILE
Gives quality finish on a large variety of parts.

PORTABLE
One man carries. Weighs only 96 lb.

LOW COST
Easy to buy and saves money.

Suppliers of all types of Barrel and VIBrAtOrY Finishing Equipment, materials and processes

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NRP 3659

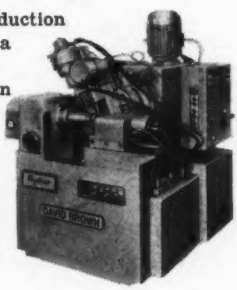
OA/7089B

David Brown precision machine tools for gear production

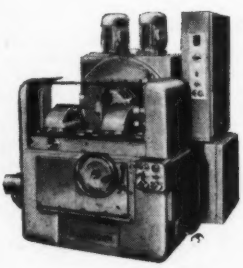
The UPH.30 Ultra Precision Hobbing Machine produces gears up to 30in. diameter. It incorporates electronic accuracy control, the measuring accuracy at 30 in. diameter being 0.00015in.

The design of David Brown precision gear cutting and finishing machines is based on the experience of over 100 years. The range is the widest offered by any one company, and covers all types of production techniques for spur and helical gears up to a size of 18 feet diameter. The four machines shown are typical of the whole range, in that within their fields, they combine a high degree of accuracy with high production rates. David Brown machines like these are giving fine service in nearly every country of the world.

The No. 10 Hydrax High Production Gear Hobbing Machine has a capacity of 10in. diameter. Capable of the fastest known production rates, it is used extensively by the automobile and tractor industries throughout the world. The Complimentary Production Gear Shaving Machine is described below.



The range of Turbine Gear Hobbing Machines has capacities up to 18 feet diameter, which makes the machines of special interest to producers of marine gears where a very high degree of accuracy is essential. This range can also incorporate electronic accuracy control. A similar range of combined turbine gear hobbing and shaving machines, and turbine gear shaving machines is manufactured.



The S12H automatic high-speed Gear Shaving Machine is designed for the rapid shaving of spur and helical gears by the radial loading method, employing the rotary crossed-axis principle. This machine is versatile since three different shaving techniques can be used.

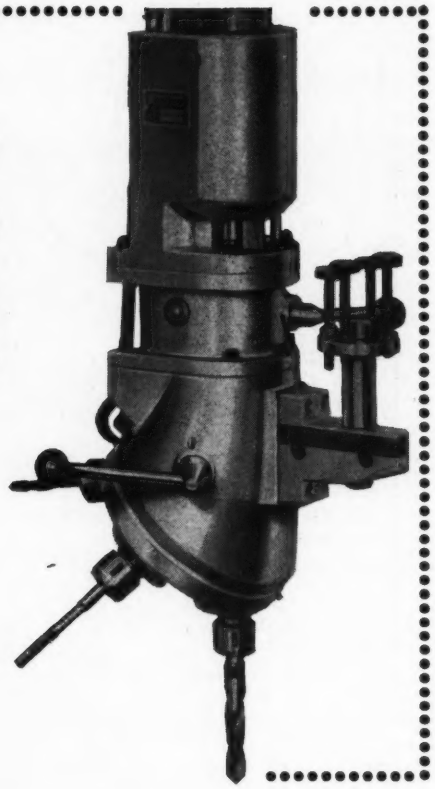
DAVID BROWN

An alliance of engineering specialists in gearing, machine tools, tools, castings, automobiles and agricultural tractors and machinery

THE DAVID BROWN CORPORATION (SALES) LIMITED

MACHINE TOOL DIVISION, ASHBURTON ROAD, TRAFFORD PARK, MANCHESTER 17. TEL : TRAFFORD PARK 4741

BOROMAT
AUTOMATIC
TURRET DRILLING HEAD



CONVERTS SINGLE SPINDLE DRILLS INTO HIGH PRODUCTION MULTI-OPERATION MACHINES

- Performs drilling, reaming, countersinking, counterboring, tapping, etc., in AUTOMATIC sequence
- 4, 5 or 6 Stations
- Only the tool in actual operation rotates
- Easily fitted to most makes of vertical drill

THREE SIZES :

Model B8..... $\frac{5}{16}$"
Model B15 ..... $\frac{9}{16}$"
Model B23 ..... $\frac{7}{8}$"

On models B8 and B15 a two-speed gearbox is available, giving a 3-1 reduction. Tapping attachments are supplied for all models.

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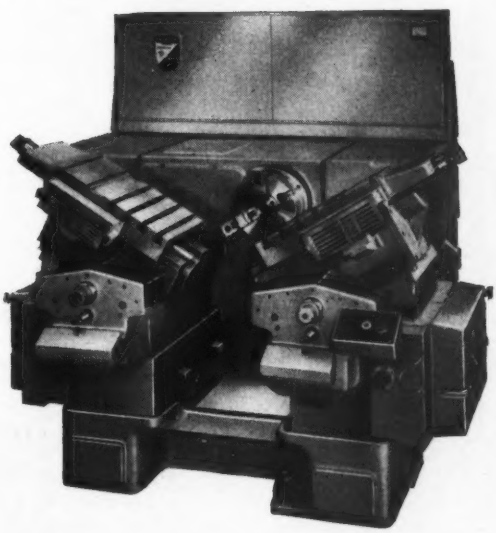
FRONTOR

Front-operated multi-tool chucking lathes

The latest development of a remarkably efficient lathe design: Ideally suited to small, medium or large batch production the FRONTOR machines offer marked advantages in both setting and operating and require a minimum of floor area.

Available with

- Semi-auto cycle
- Transfer equipment
- Constant feed facing
- Auto-cycle with magazine feed
- Copying attachments
- Automatic chip disposal



FRONTOR machines are a joint development of two leading German machine tool manufacturers:

J. G. Weisser Söhne

FRONTOR 25

Nominal turning diameter: 9¾ in.

Maschinenfabrik Diedesheim

FRONTOR 40

Nominal turning diameter: 15¾ in.

Write for full details

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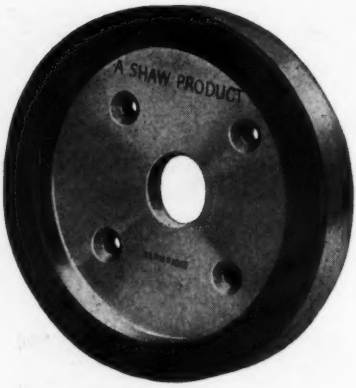

speedier operating

precision to the limit

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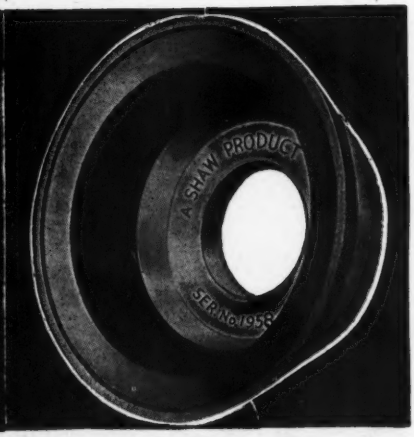

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BURGMASTER

The World's Largest Builder of Turret Drilling Machines

AUTO-INDEXING BENCH MODEL TURRET DRILLING MACHINE

Most plants give cursory consideration to drilling costs which can be expensive—particularly the production of multiple hole sizes in a single workpiece! Why? Because conventional drilling equipment has not kept pace with production tools. Gang drills, the usual production tool, are slow, costly, wasteful of time, motion and space, and are fatiguing in operation.

THERE'S A BETTER WAY—

The Bench Model Burgmaster is precision made and designed for the specialized production of small holes and related machining operations. It is small, compact and requires a fraction of usual bench space. The practice of moving the fixture from spindle to spindle and realigning the work to the tool is costly in both time and production. The Burgmaster eliminates this waste, by bringing the spindle to the work.

Check the features of this new Burgmaster, there's nothing like it . . . in size, in speed, in low original cost!

POWER-INDEXING
Built-in power-indexing mechanism with safety clutch. A touch of the feed lever at the top of the stroke triggers the clutch which rotates the turret automatically.

PROGRESSIVE SPINDLE SEQUENCE
Spindle speeds vary with each station for greatest overall application efficiency. For example, the operator can centre drill and tap in orderly sequence —each spindle operates at a successively slower speed required for each job. Machines with special speed sequence can be supplied for single purpose applications.

SPINDLES
All spindles are mounted in precision ball bearings. Anti-friction bearings are used throughout the indexing mechanism.

TWO COMPLETE SPEED RANGES
Two speed ranges provide a high and low range or a total of 12 available spindle speeds.

OVERLOAD SLIP CLUTCHES
Both spindle drive and indexing mechanism are protected with overload slip clutches.

INDIVIDUAL SPINDLE SPEEDS
Each spindle operates at its own speed . . . the speed best suited for most efficient machining with all tool diameters up to $\frac{1}{4}$". No gear or belt changes are required. All spindles are dead except the one in use.

ADJUSTABLE DEPTH STOPS
Individual preselective stops are provided to limit the tool travel of each spindle.

SPECIFICATION

Maximum capacity – $\frac{1}{4}$" in steel
Maximum chuck to base clearance – $10\frac{1}{2}$"
Maximum feed – $2\frac{7}{8}$"
Centre of spindle to column clearance – $5\frac{1}{8}$"
Machined pad – $7\frac{3}{4}$" x $11\frac{1}{4}$"

Immediate Delivery .....

ENQUIRIES ALSO INVITED FROM MERCHANTS

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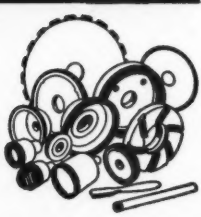
MBP 5386

for perfection in diamond wheels



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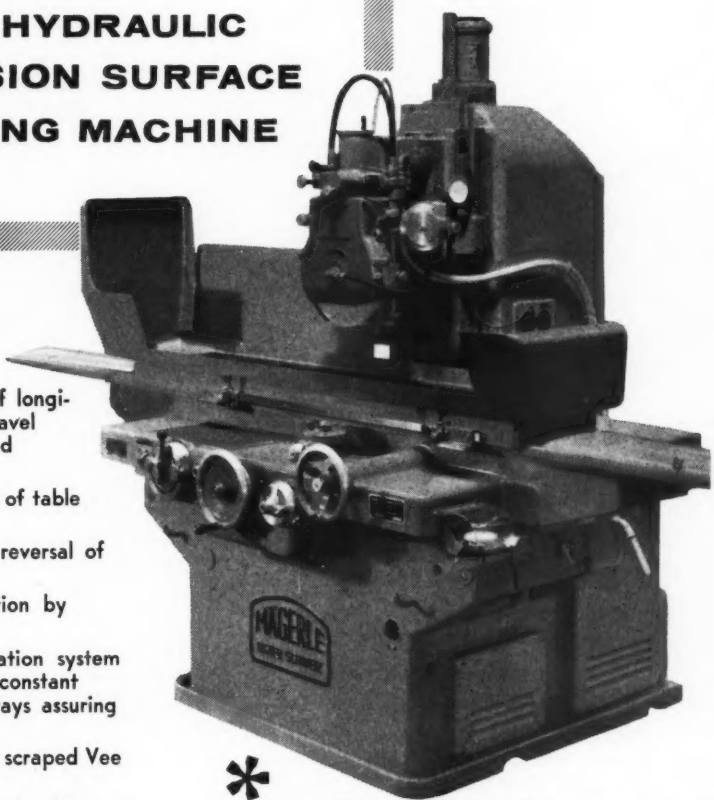
MÄGERLE

FULLY HYDRAULIC PRECISION SURFACE GRINDING MACHINE



- Fully hydraulic control of longitudinal and transverse travel of worktable and diamond dresser.
- Infinitely variable control of table speeds and dresser.
- Fully cushioned, smooth reversal of table.
- Extremely simple operation by modern controls.
- Efficient capillary lubrication system maintains an oil film of constant thickness on the table ways assuring maximum precision.
- Strongly ribbed bed with scraped Vee and Flat guideways.
- Independent drives for hydraulic pump, grinding spindle and rapid feed of wheel head.
- Accurately to ±0.00004mm. functioning vertical and transverse movement.
- 5 h.p. Spindle Motor.

* **Automatic grinding wheel down feed**

Automatic feed of the wheel-head can be regulated from 0.0001" to 0.0005" and is controlled by the reversal of the work-table longitudinally or transversely.

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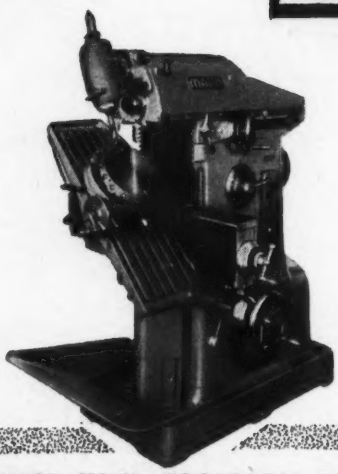
NRP 3573

MAHO

THE MOST COMPLETE RANGE OF UNIVERSAL JIG MILLING AND DIESINKING MACHINES

These Four Universal Tool Milling and Diesinking Machines cover the requirements of all toolrooms large and small. Absolute versatility is provided by unique construction and extremely wide range of auxiliary equipment, including optical co-ordinate setting for jig boring. This range enables tools to be machined up to approximately one ton in weight.

MMT



CHECK YOUR TOOLROOM REQUIREMENTS AGAINST THESE MODELS

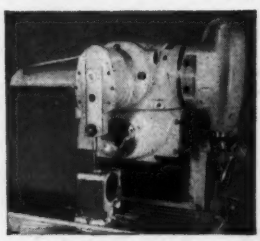
MAHO MH.600. Table 24" x 8¾", horizontal spindle speed 55 - 1000 r.p.m., vertical spindle speed 99 - 1650 r.p.m.

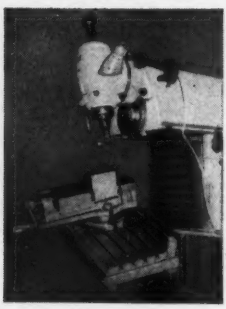
MAHO MH.700. Table 27½" x 10¼", horizontal spindle speed 65 - 1000 r.p.m., vertical spindle speed 99 - 1650 r.p.m.

MAHO MH.800. Table 31½" x 12½", horizontal spindle speed 32 - 1320 r.p.m., vertical spindle speed 45 - 1900 r.p.m.

MAHO MH.1000. Table 47¼" x 14½", horizontal spindle speed 40 - 2000 r.p.m., vertical spindle speed 40 - 2000 r.p.m.

Models MH.800 and MH.1000 are equipped with independent spindle drive motors mounted on ram.

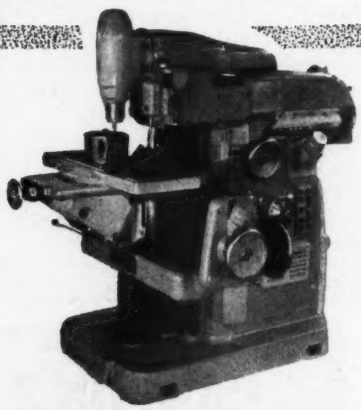




OPTIONAL EXTRA ACCESSORIES INCLUDE . . .

High speed vertical milling heads, slotting attachment, rotary table, fixed swivelling, tilting and inclinable tables, punch milling attachment, dividing head and spiral milling attachment, and on the larger models power fed vertical milling attachment will be available. It is also possible on the MAHO model MH.800 to fit this machine with hydraulic copying equipment, and on the model MH.1000 HEID electronic copying equipment is available.

Optical readers and rules can be supplied for the headstock slide, longitudinal traverse slide and vertical traverse slide.



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Do you know?

That production costs can be reduced by as much as ⅓ by using CARBORUNDUM's resinoid bonded wheels on floor stand grinders. Take for instance the fettling of these chain links—ideal type of work for this method of grinding.

Our customer's actual operation details are as follows:

COMPONENT GROUND: Chain Links

MATERIAL: White heart malleable iron. 400 Brinell hardness.

MACHINE: High speed floorstand.

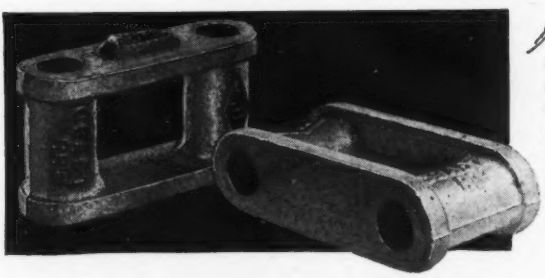
WHEEL GRADING: C16—S3—BC4.

NUMBER GROUND: 12000 links.

GRINDING RATE: 300 per hour.

ABRASIVE COST: 0.096 pence per piece.

These figures mean that since changing to CARBORUNDUM's wheels, an increased production of 33⅓% was possible.



CARBORUNDUM can help you to achieve this kind of production and economy. And not only on snagging and fettling operations. Whatever your grinding process, whatever your problem, we have experts who can advise on the best and most efficient use of abrasive materials.

Write and ask for a representative to call.

BONDED ABRASIVES DIVISION

THE CARBORUNDUM COMPANY LTD
TRAFFORD PARK, MANCHESTER 17

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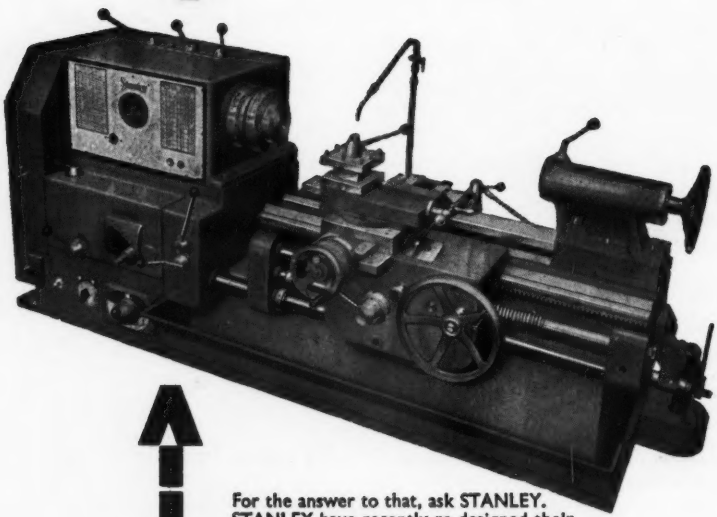
WHAT'S NEW IN SLIDING BED LATHES?



For the answer to that, ask STANLEY. STANLEY have recently re-designed their 10½ inch Sliding Bed Lathe to incorporate several improvements.

The new Stanley is heavier—has greater horse-power—a wider bed—totally enclosed, built-in electrics. It can be supplied with a back turning rest to turn large diameters the full length of the open gap. The Stanley Sliding Bed Lathe is really two lathes in one. It can be used as a standard centre lathe and also for large diameter, large width jobs which would otherwise call for a special machine.
Stanley lathes have been serving satisfied users all over the world for more than twenty years. The new model is designed and built to carry on this fine tradition.

All you want to know about the improved Stanley Sliding Bed Lathe is contained in a new catalogue—sent on request.

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Laurence Scott & Electro Motors Ltd., Messrs. Hoover Ltd., A. V. Roe & Co. Ltd. Mullard Ltd., The Manchester Dry Docks Co. Ltd., Swan, Hunter & Wigham Richardson Ltd. J. Samuel White Ltd.

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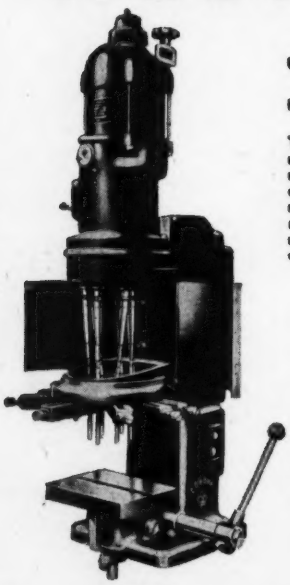
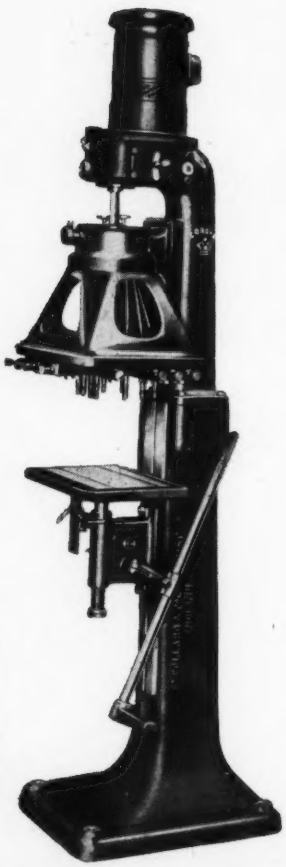


TYPE 12 MX
UP TO 12 SPINDLES IN AN AREA OF 12in. — 8in.
MAXIMUM DRILLING CAPACITY 1in.

These machines keep costs low on multiple repetition drilling. Any number of spindles up to 12 can be employed and adjustment is rapid and simple. Feed is by lever and rack-operated table with a vertical adjustment of 20in. Available with electrical reverse.

TYPE 6 MX
BENCH OR PEDESTAL
UP TO 10 SPINDLES IN AN AREA OF 5in. DIA.
MAXIMUM DRILLING CAPACITY 0.196in.

Available with or without electrical reverse, these machines will drill and tap small components at very fast rates. Tee-slotted table has lever feed. Head has 6in. vertical adjustment. Two speed ranges through gear box. Maximum speed 3,000 r.p.m.



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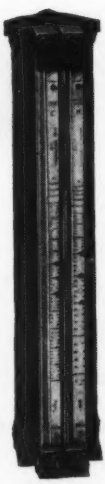

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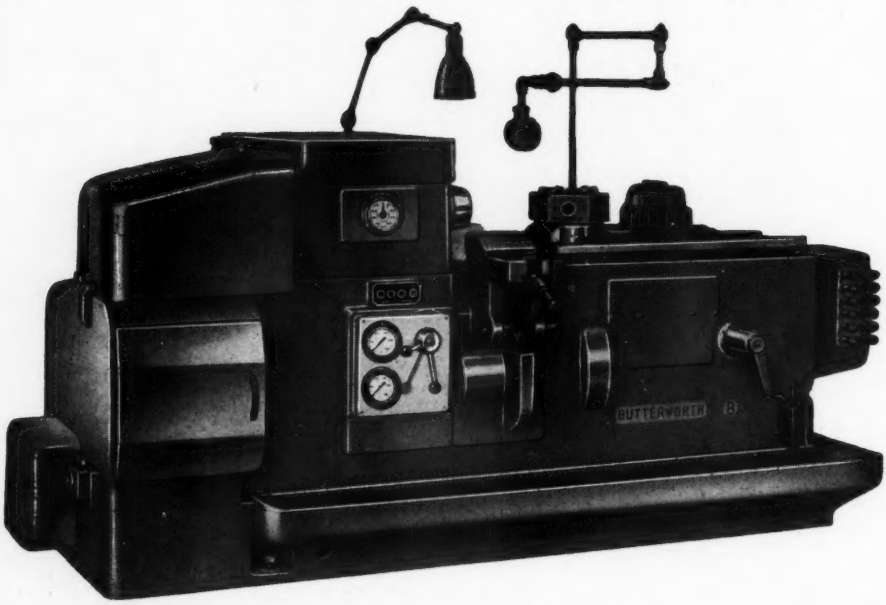

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★ *FOR BAR AND CHUCK WORK*

The many outstanding features of this machine ensure faster cycle time and lower costs per piece . . . even on short runs. No special cams are needed and the exceptionally wide speed range covers all materials, from light alloys to high tensile steels. Hydraulic feed control. Hydraulic chucking. Hydraulic bar feed.

Three sizes, with capacity for rounds of 1⅝in., 2in. and 2½in. respectively.

Hydraulic copy turning attachment and cross slide longitudinal turning attachment available.

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BUTTERWORTH
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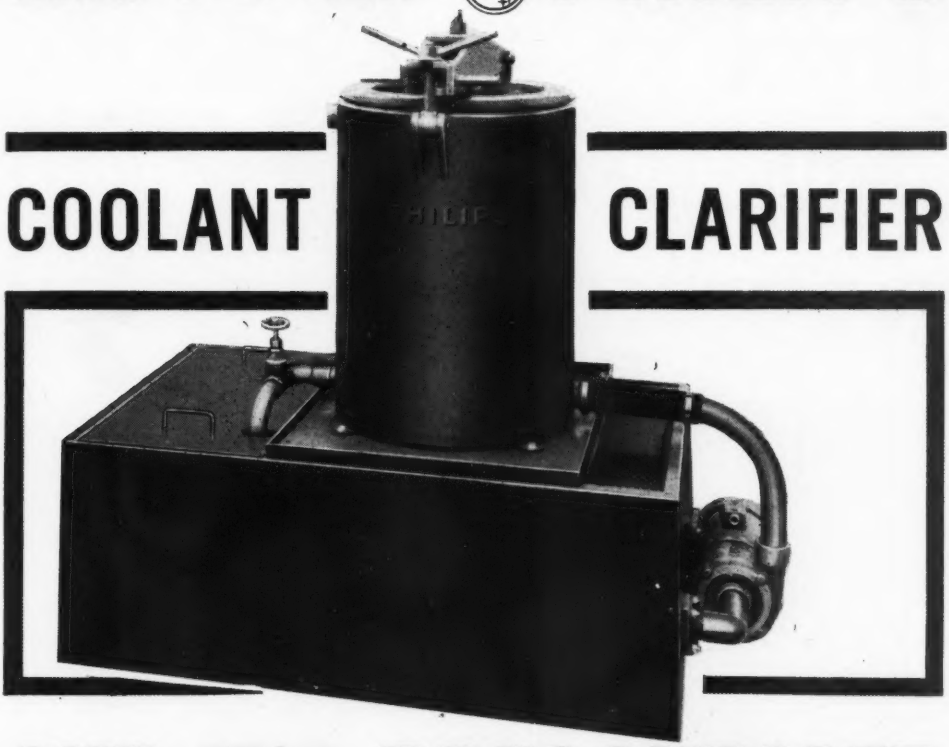
HERE'S A NEW PHILIPS

COOLANT CLARIFIER



AND IT'S PRESSURISED

- THE FILTER FOR MICRO-FINISHING
- CANNOT OVERFLOW
- HIGH EFFICIENCY
- SIMPLE INSTALLATION
- ONLY ONE PUMP USED
- DELIVERS 30 GALLS. A MINUTE
- SLUDGE CAPACITY: 2 CWTS.
- COUNTRY-WIDE SERVICE
- COST — £225 COMPLETE

This new Philips Pressurised Coolant Clarifier offers a long list of unbeatable advantages. It gives a higher degree of filtration, essential for fine-finish processes. It cannot overflow, so no warning devices are needed. A specially developed inlet system keeps the filter clear until the filter-bag is full. Only two connections are needed: a flexible hose to coolant outlet, and a cable to the motor. Holding up to 2 cwt. of sludge, Philips new Coolant Clarifier operates for long periods without requiring attention, and is suitable for use with both ferrous and non-ferrous materials. With all these outstanding advantages, this new clarifier is by far the most advanced machine available, yet it costs only £225 *complete.*

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Our booklet SP.178 "Machine Tool Lubricants" contains important data on this subject and is free on request.

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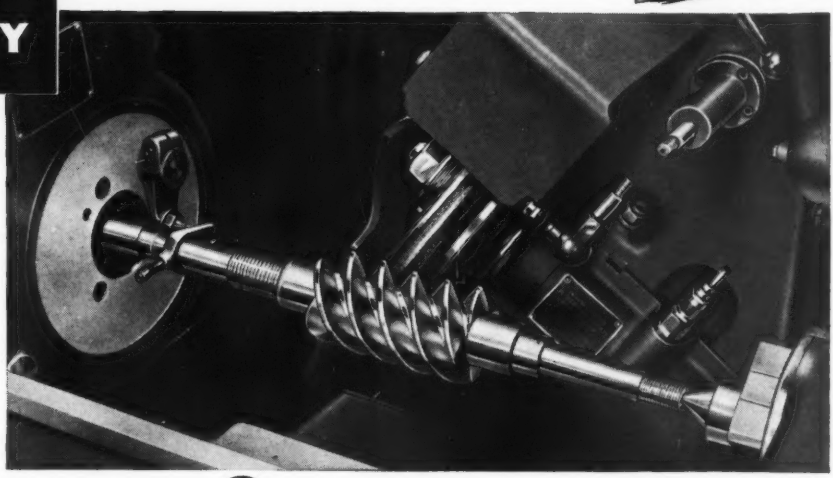
GRINDING MACHINES TW1420 TW1442



AUTOMATIC INDEXING OF UP TO 20 STARTS

Work indexed during table fast return stroke, reducing idle time.

16″ diameter wheel — form generated by special dresser to eliminate interference.

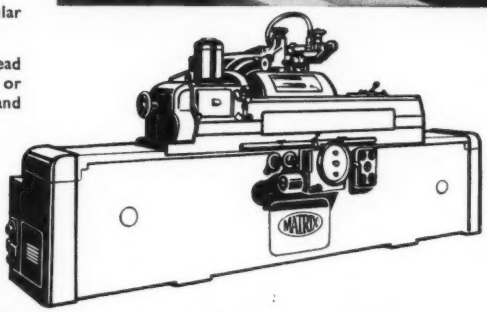
Root and both flanks ground simultaneously.

Work up to 14″ x 20″ or 14″ x 42″ admitted between centres.

Ideal for grinding circular thread rolling dies.

Also for precision thread grinding with single or multi-ribbed wheel and form grinding.

A Coventry Gauge & Tool Co. Product



Automatic work indexing combined with the automatic withdrawal and return of the grinding wheel enables multi-start worms and threads to be produced with the minimum of attention from the operator. For grinding worms with helix angles exceeding 8°, the special Generating Dresser overcomes the interference normally caused by the grinding wheel diameter, helix angle and depth of thread, allowing a 16″ diameter wheel to be used.

BRIEF SPECIFICATIONS	TW1420	TW1442
Maximum work diameter	14″	14″
Maximum distance between centres	20″	42″
Maximum length ground	18″	40″
Maximum helix angle (right and left)	45°	45°
Number of starts	1-20	1-20
Pitch range	0·025″-12″	0·025″-12″
Grinding wheel diameter	16″	16″
Grinding wheel motor	3½HP	3½HP

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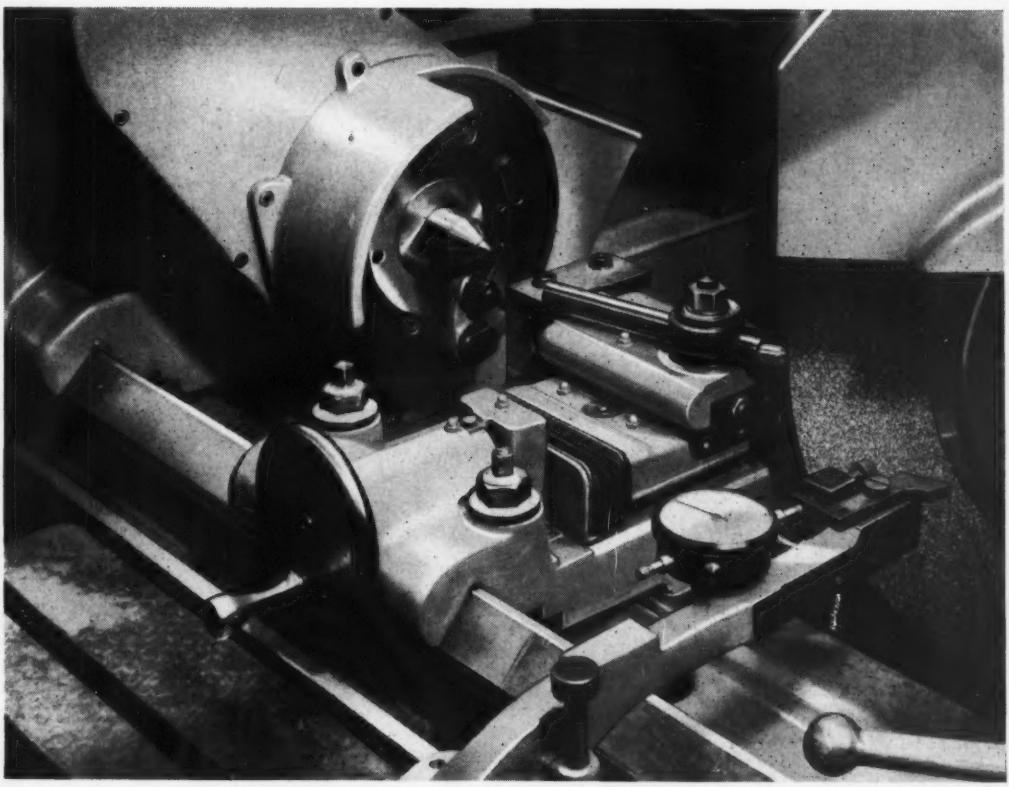

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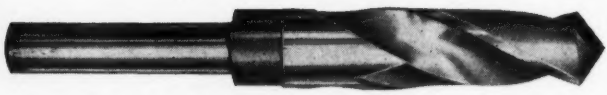

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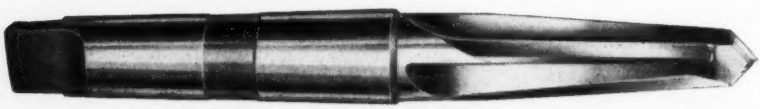

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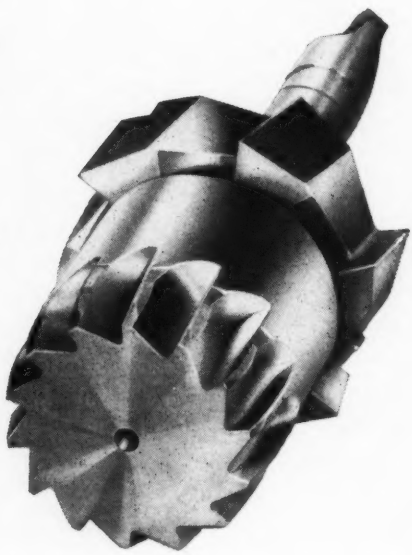

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The SICMATIC puts small batches into the mass production range

HYDRAULIC PROFILING AND COPYING LATHES

FEATURES INCLUDE:

1 Capacity 14in. by 27in.
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4 Auto cycling up to six depths of cut.
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7 Eight models to choose from.

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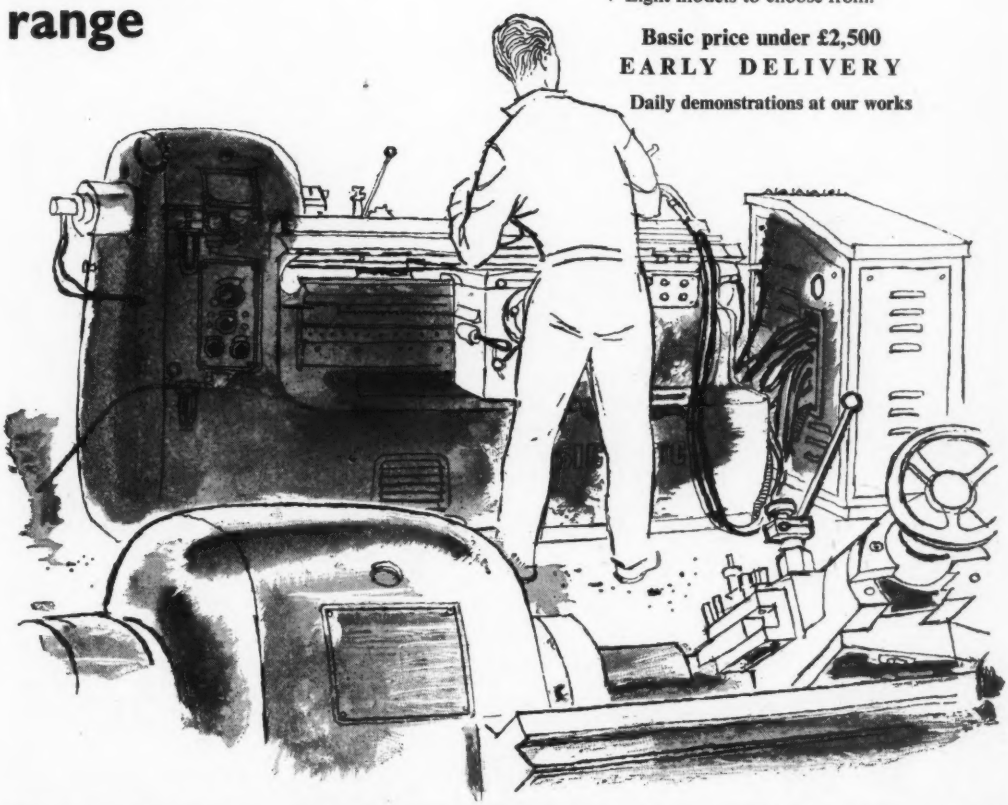

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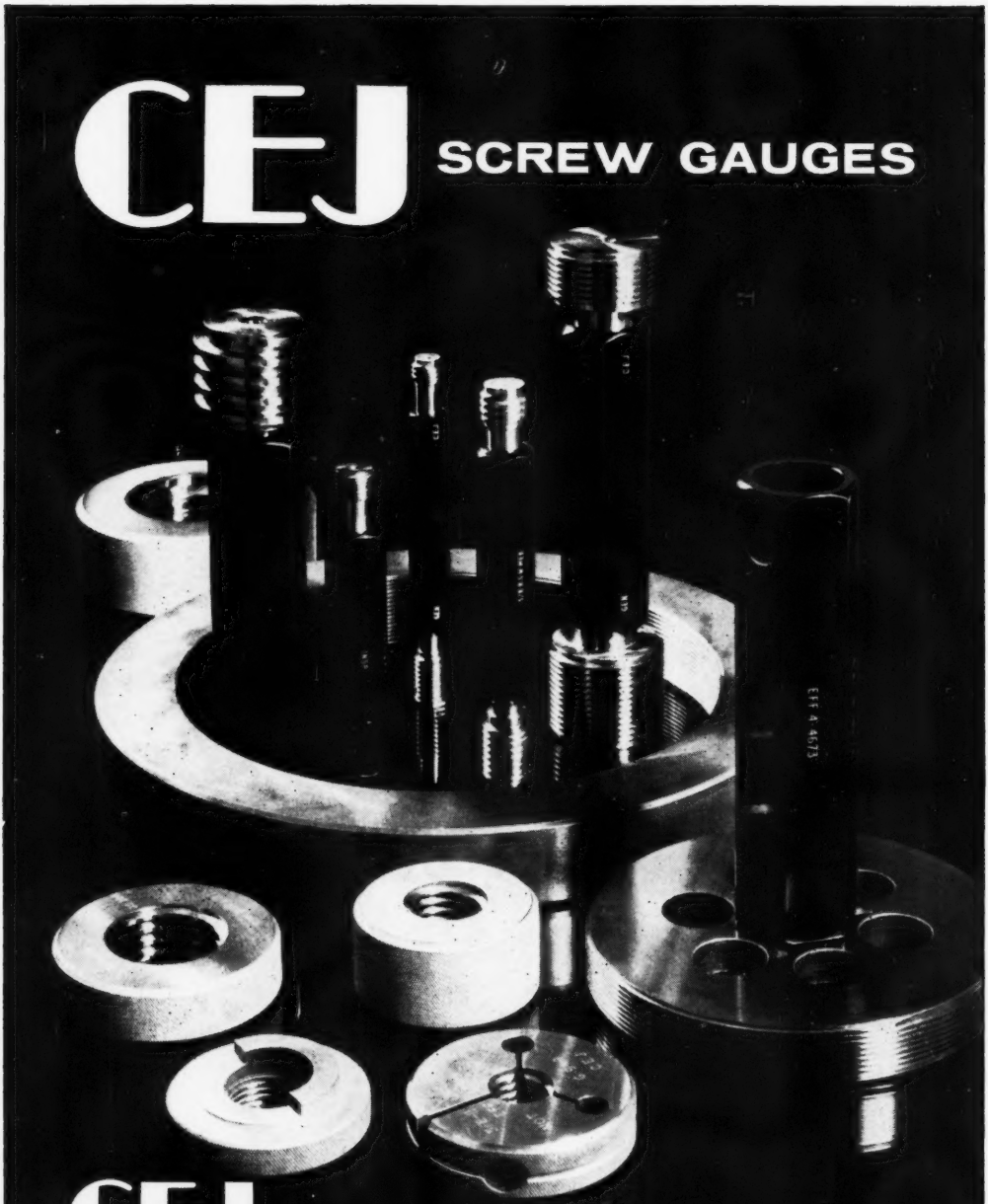

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Superb performance
Attractive price
Quick delivery

All models complete with Standard Equipment including :

- Cos-par Universal Dividing Head
- Vertical Milling Attachment
- Arbor
- Front Support Braces

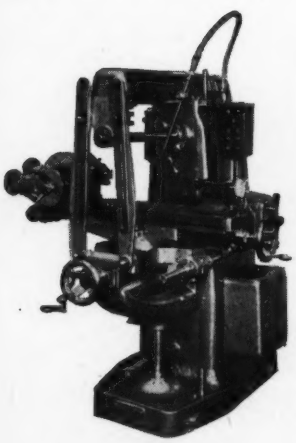
Specification :

Model	No. 0	No. 1	No. 2
Table	34" × 8¼"	39⅜" × 9"	48" × 11"
Long. Trav.	20"	26"	29"
No. of Speeds	12	9	18
Speeds R.P.M.	32-1000	60-1200	40-2000
Spindle Nose	No. 40	No. 40	No. 40
PRICE ★	£880	£1100	£1825

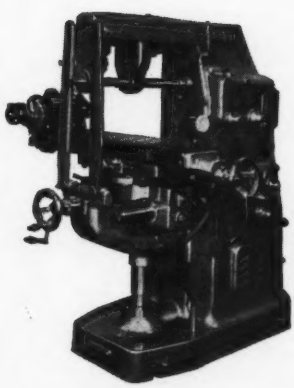
TEST

UNIVERSAL MILLING MACHINES

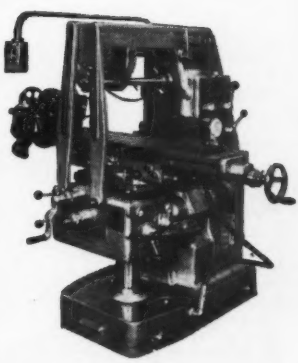
Model 0



Model 1



Model 2



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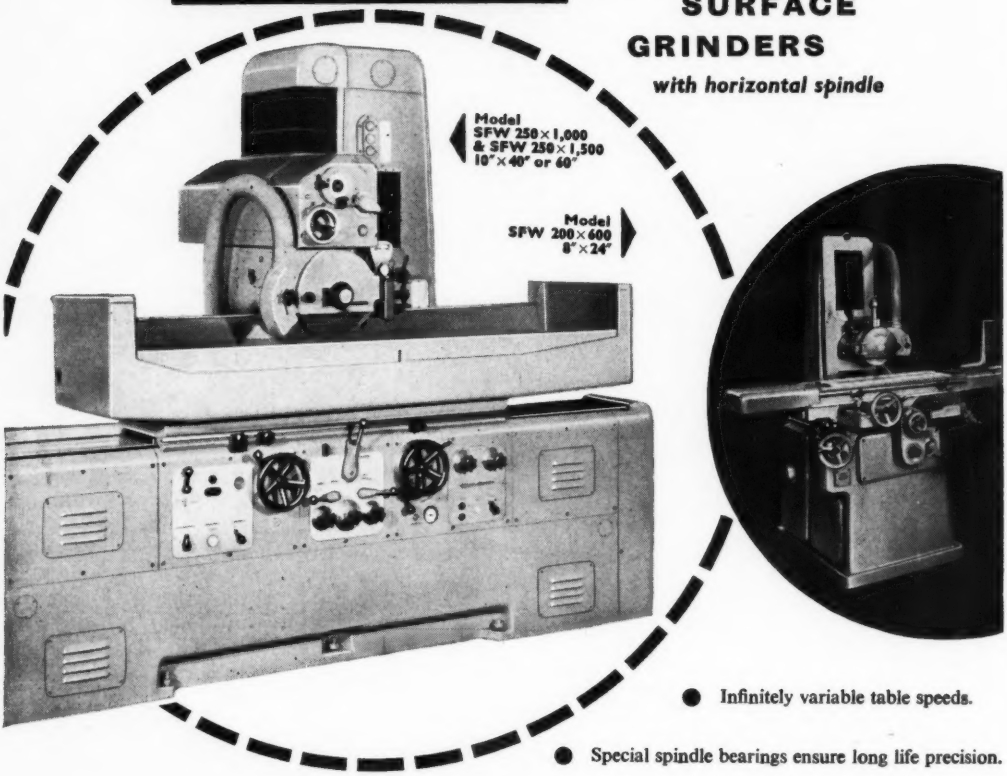
MIKROMAT

HYDRAULIC SURFACE GRINDERS

with horizontal spindle



- Infinitely variable table speeds.
- Special spindle bearings ensure long life precision.
- Construction in every detail to the highest standards.

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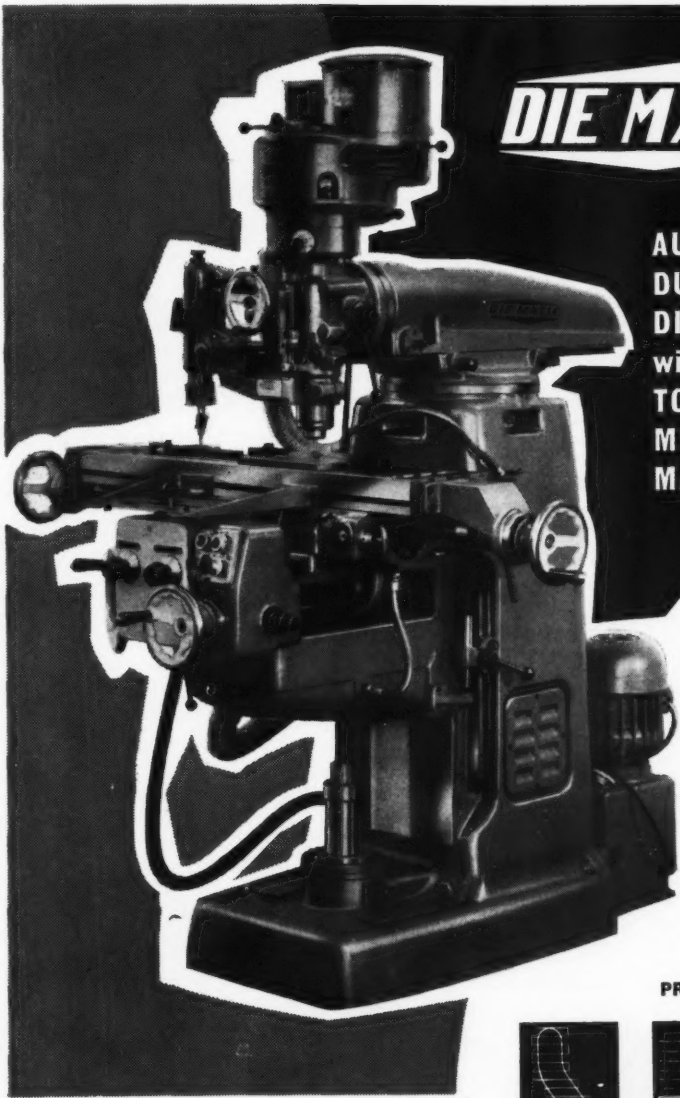
AUTOMATIC HYDRAULIC DUPLICATING DIE-MILLER combined with a TOOL-ROOM MILLING MACHINE

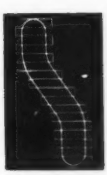


SPECIFICATION

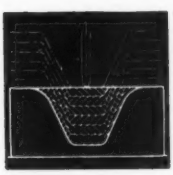
Working surface	43in. × 10in.
Max. dist. spindle to table	14½in.
Longitudinal table trav. (hydr.+manual)	14in. + 14in.
Vertical (knee) hydr.+manual	4in. + 13in.
Vertical (quill) (mechanical)	5in.
Cross (saddle) (hydr. + manual)	10in. + 10in.
Spindle speeds range r.p.m.	80 to 2715

PRICE £2,125 - 0 - 0 ★

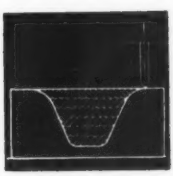
3 Hydra-Way Duplicating *(Finishing)*



1 Automatic Horizontal Scanning of the Model "by Lines"



2 Vertical Depth Duplicating Multicuts by Parallel Layers



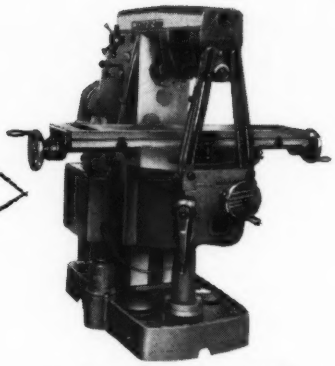
3 Vertical Depth Duplicating Multicuts by Fist Layers

★ **Special terms for members of B.A.M.T.M.**

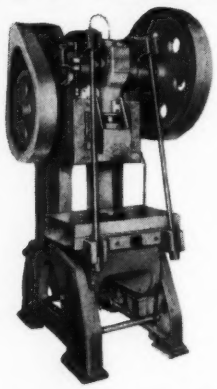
HERBERT WIDDOWSON & SONS LIMITED

Canal Street Works, Nottingham. Tel: 51891 (4 lines). Grams: Tools Nottingham

Dimco B.C. 2000 Universal Milling Machine
Table size 48in. by 11in. Swivels 45°
Power feed in all directions
Spindle Speeds 30 – 1320 r.p.m.
Spindle No. 40 ISA
PRICE £1350 0 0
Extra Equipment Vertical attachment £100 0 0
8in. plain dividing heads £74 0 0



Dimco manufacture and distribute



Dimco 60 ton open fronted inclinable
Power press adjustable stroke – geared
Table surface 29½in. by 18¾in.
Strokes per minute 70
Nett weight 6,175 lbs.
Dimensions 44ins. by 62ins. by 97in.
PRICE £995 0 0
Standard Equipment:—Bolster plate, pressure on shot lubrication, belt guards, foot operated electric switch. Two button hand switch. Motor and electrics 400/440/3/50.

British and Continental machine tools

Dimco CM 60 Universal Milling Machine
Table size 42in. by 9½in. Swivels 45°
Power feed and Rapid Traverses in all directions.
Spindle speeds 50 – 890 r.p.m.
Spindle No. 40 ISA
PRICE £955 0 0
Extra Equipment Universal
Vertical attachment £45 0 0
Universal dividing head £65 0 0

DIMCO (GT. BRITAIN) LTD.

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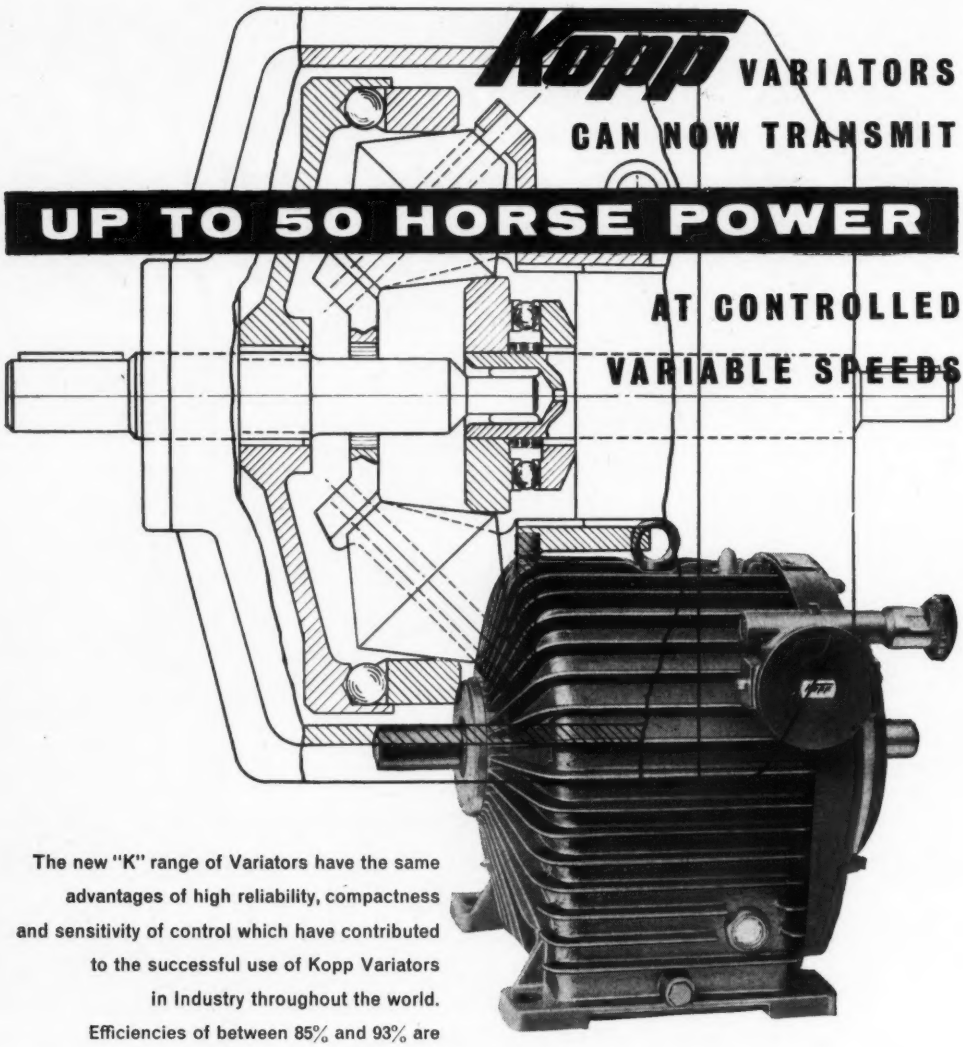

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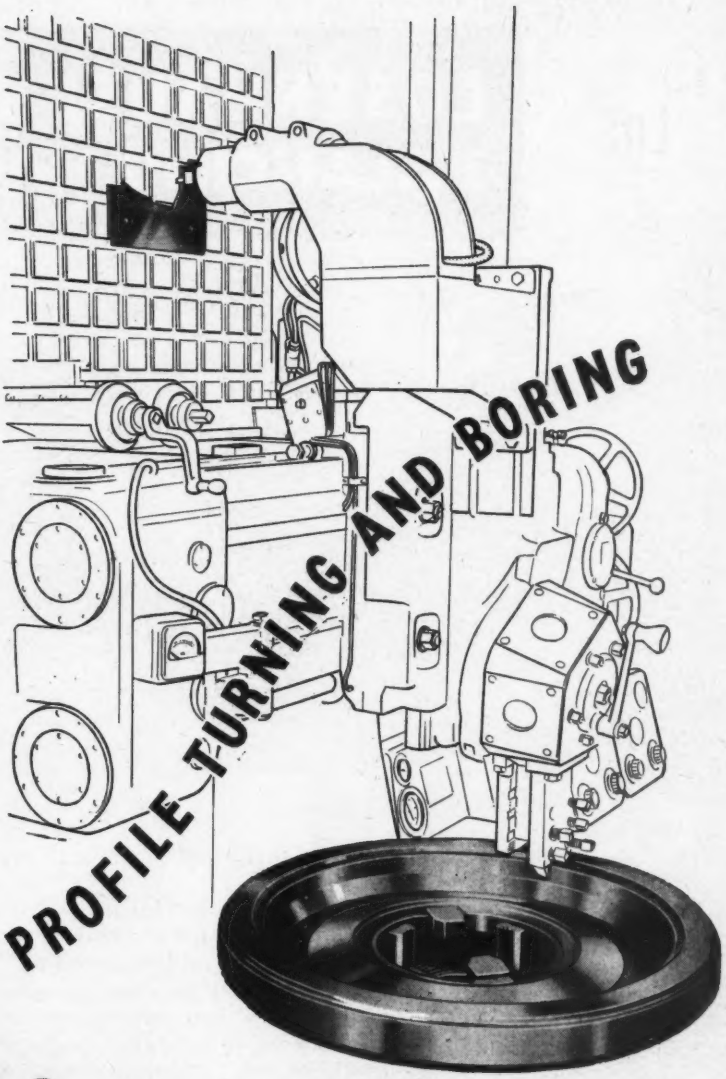

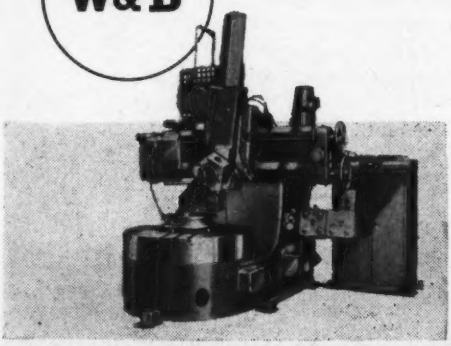

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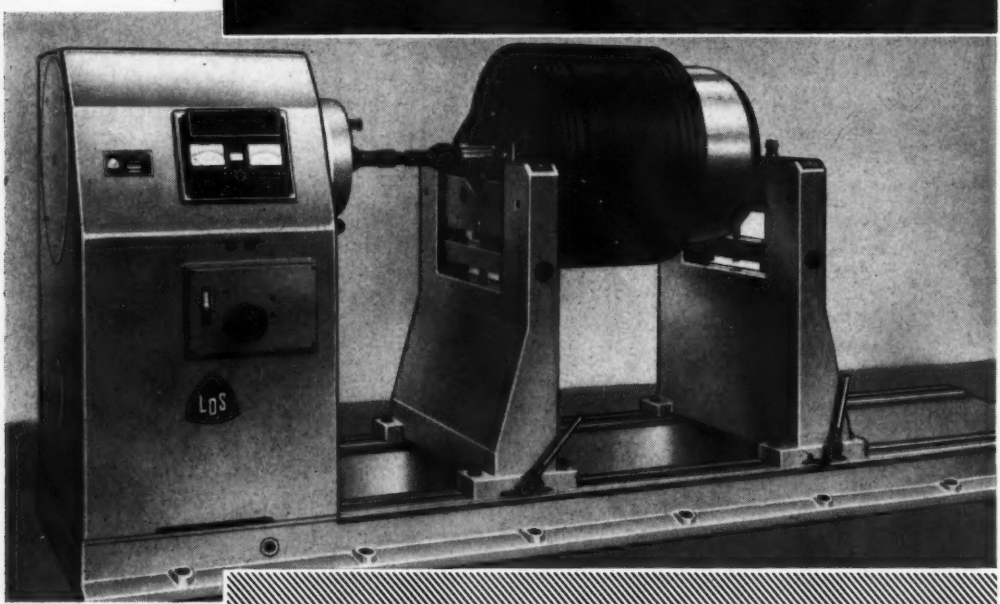

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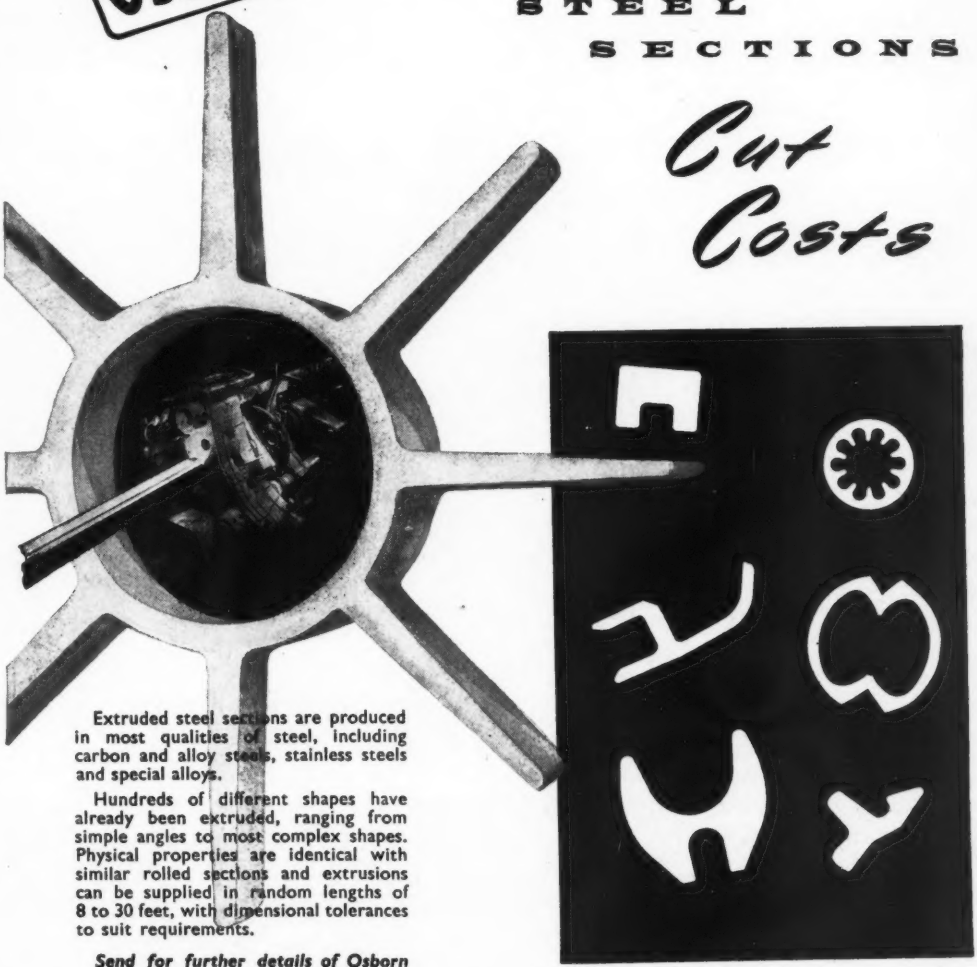

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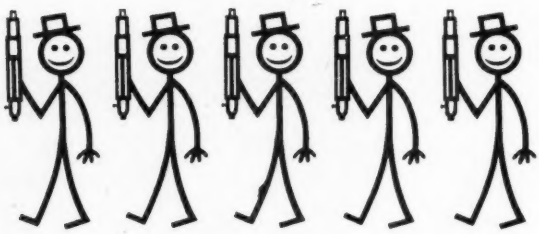

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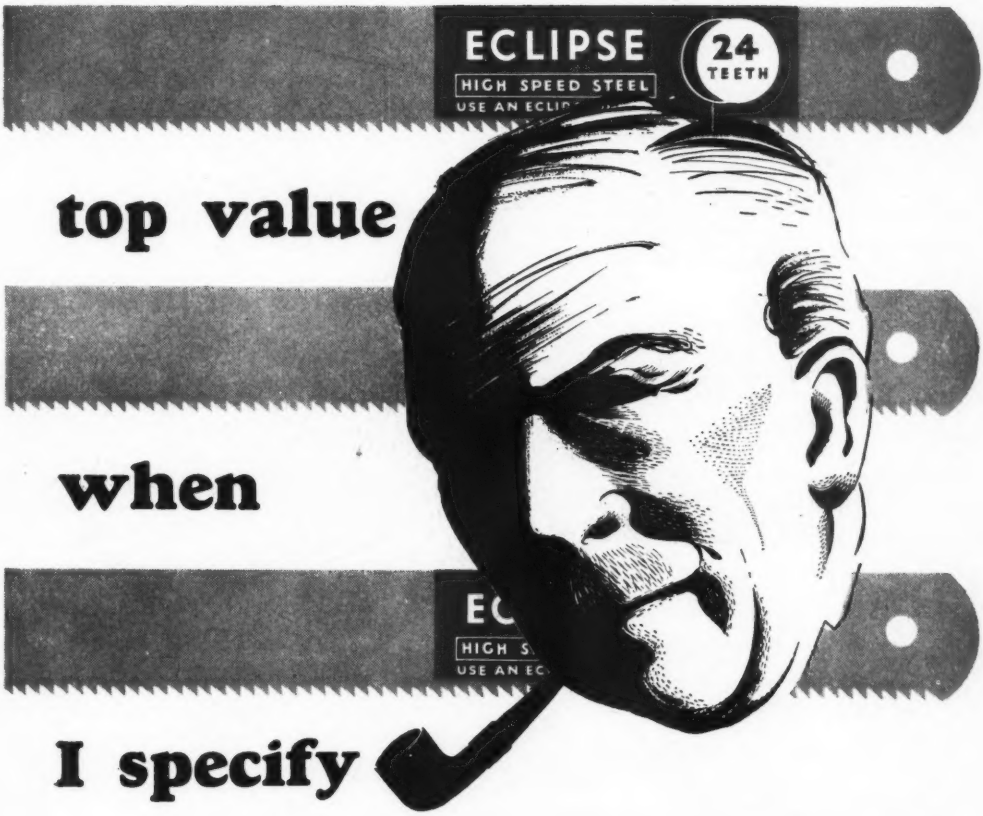

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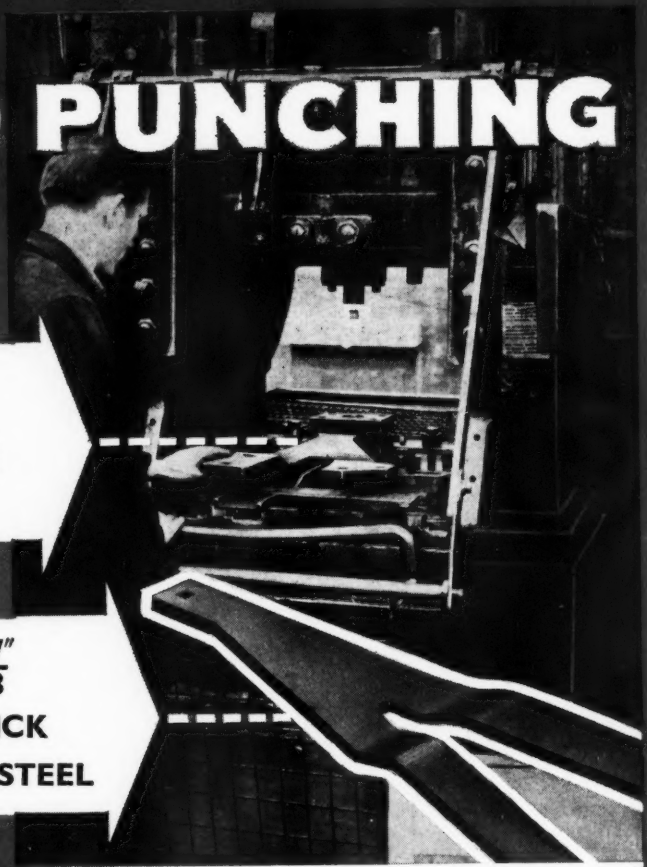

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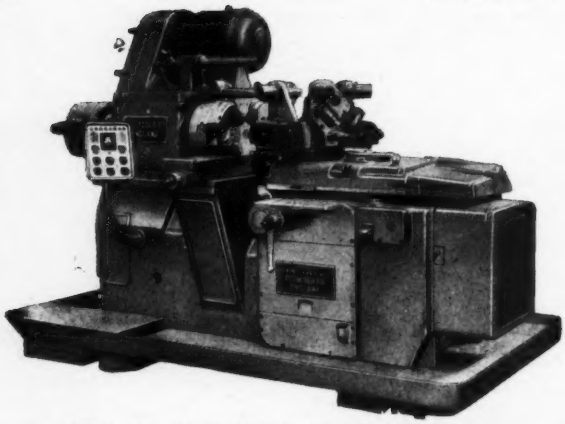

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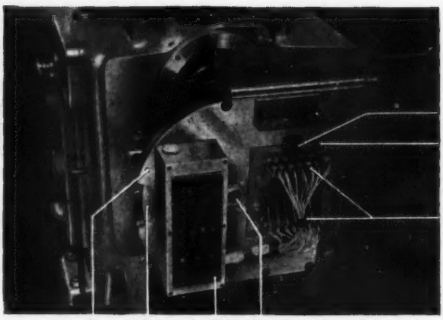

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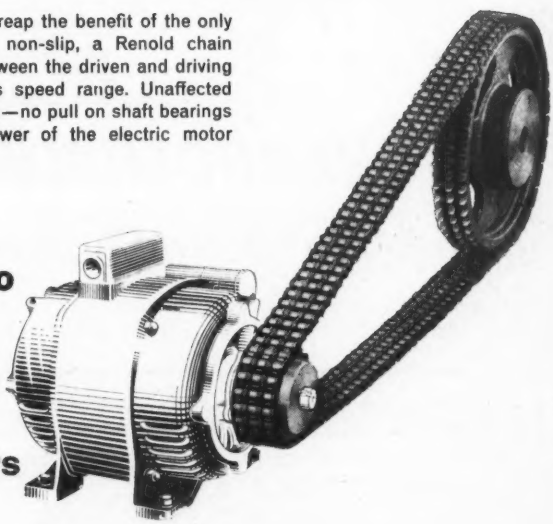

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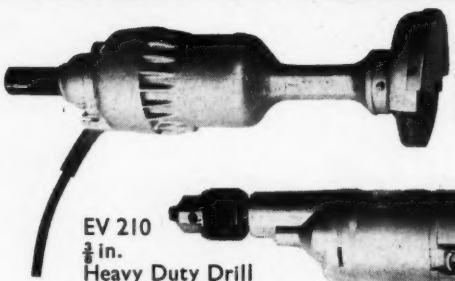

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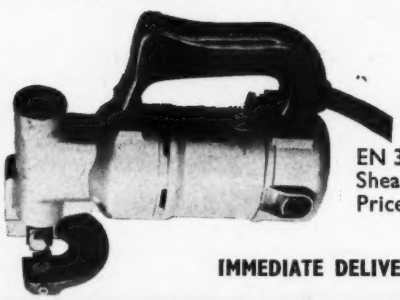

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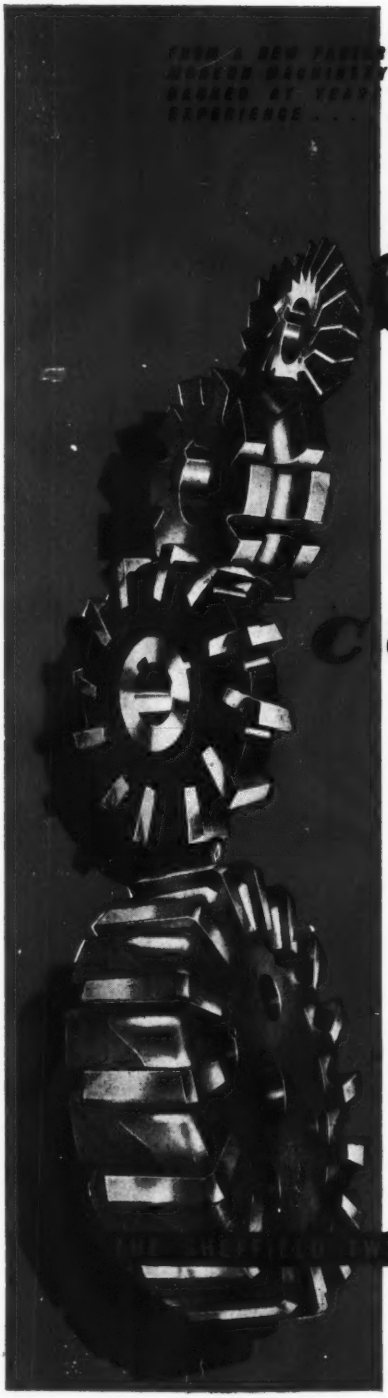

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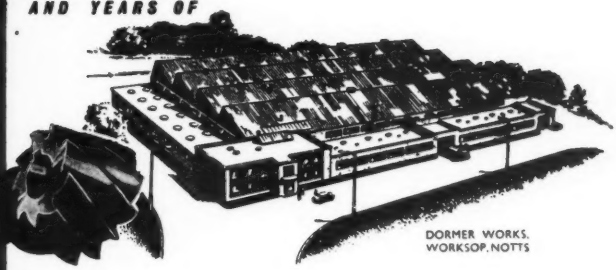

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A JOURNAL OF METAL-WORKING PRACTICE & MACHINE TOOLS

Vol. 99, No. 2562 December 20, 1961

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E.

Abstracts of Principal Articles

The Manufacture of Typewriter Type P. 1416

The activities of T. S. Precision Engineering, Ltd., Brighton, who supply components for business machines under sub-contract to many companies, include the manufacture of typewriter type, which is made at rates up to 100,000 pieces per week. Reference is made in this article to the methods employed for type production from special rolled-section material which is first cropped to length and formed to U-section. A special automatic machine with a 6-position indexing table is then employed for cold-forming the characters in a 4·5-sec. cycle. Subsequently, the blanks are trimmed, to remove the excess material squeezed out at the swaging operation, case-hardened and nickel-plated. Some details are also given of a special engraving machine employed for making the matrices employed on the swaging machine. (MACHINERY, 99—20/12/61.)

The Automatic Grinding of Ball-bearing Races .. .. P. 1427

In this second article, describing high-capacity plant installed recently at the works of the Hoffmann Manufacturing Co., Ltd., Chelmsford, Essex, for the automatic grinding of ball-bearing inner and outer races, the Landis 4-in. Concentric machines employed for track grinding inner races are discussed. These machines operate on the "third shoe" centreless principle, whereby circularity is readily maintained within 0·00003 in. Reference is also made to the Heald type 1901 Centrimatic machines used for the corresponding operation on outer races, which are subsequently honed to a surface-finish within 3 to 5 micro-inches, r.m.s., on special-purpose Hoffmann 2-spindle automatic machines. On the latter, provision is made for varying the work-speed, and the rate of stone oscillation, during the cycle, for honing the work in roughing and finishing stages. According to the size of work, the cycle-times range from 28 sec. to 50 sec. (MACHINERY, 99—20/12/61.)

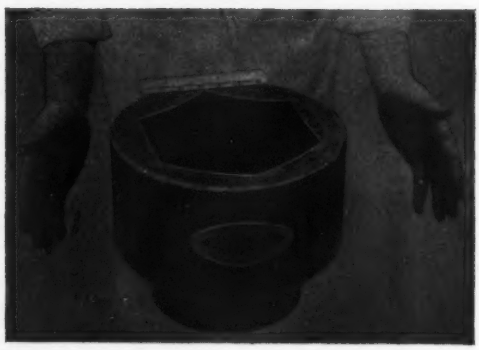
Machining Operations on Guide Rails for Passenger Lifts .. .. .. P. 1443

A set-up for machining 16-ft. 5-in. long guide rails of inverted T-section for passenger lifts, six at a time, on a Boehringer double-standard planer, is described. During the planing operation, down feed is applied to the cross rail, on the column ways, and rough and finishing cuts are taken simultaneously on the side faces of the 0·63-in. thick webs on the rails, and the top edges and chamfers are machined. A special tool slide is mounted on the cross rail which carries six solenoid-operated clapper boxes, fitted with interchangeable holders for multiple pre-set cutting tools. (MACHINERY, 99—20/12/61.)

Automatic Assembly of Shock Absorber Piston Rods .. .. .. P. 1448

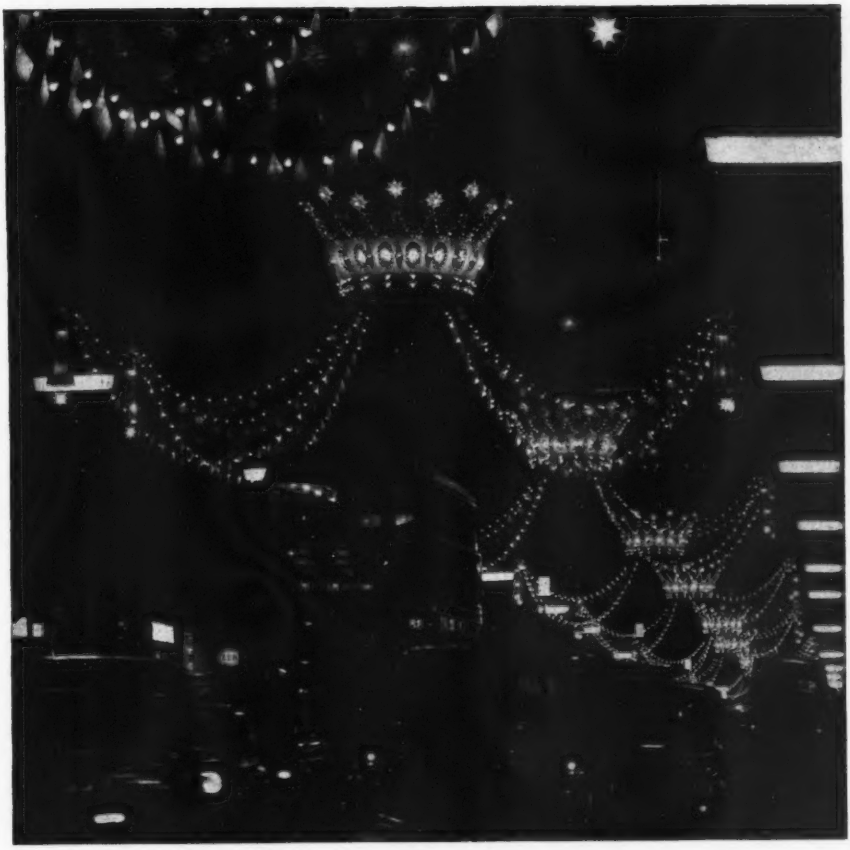
A new automatic assembly machine, designed and built by Vauxhall Motors, Ltd., has already completed the assembly of more than 2,000,000 pistons, valves and other parts to piston rods. The machine has six heads for loading valve plates and other parts made from shim-stock, which are picked up by vacuum cups and are transferred by parallel-motion mechanisms. Other heads load such parts as back-up washers, pistons, spring seats and springs, mechanically. The final head is designed to place the retaining nut in position, and to engage it with a few threads, before the assembly is unloaded and passed to another machine for torque-controlled tightening. (MACHINERY, 99—20/12/61.)

Recently produced to special order, at short notice, by Britool, Ltd., Bushbury, Wolverhampton, this wrench socket provides for tightening hexagon nuts of 7⅛ in. across flats. It is operated under power. Steel bar of 12 in. diameter was employed for the production of these sockets, and nearly 3 cwt. was required for each. By contrast it may be noted that the smallest standard size of socket measures 0·152 in. across flats



Contributions to MACHINERY

If you know of a more efficient way of designing a tool, gauge, fixture, or mechanism, machining or forming a metal component, heat treating, plating or enamelling, handling parts or material, building up an assembly, utilizing supplies, or laying out or organizing a department or a factory, send it to the Editor. Short comments upon published articles and letters on subjects concerning the metal-working industries are particularly welcome. Payment will be made for exclusive contributions.



MACHINERY Sends Christmas Greetings to all Readers and Advertisers and Wishes them Every Success in the New Year

The Manufacture of Typewriter Type

Methods Employed by T. S. Precision Engineering, Ltd., Brighton

By R. E. GREEN, Associate Editor

COMPONENTS FOR BUSINESS MACHINES such as typewriters, adding machines, and computers are produced on a large scale by T. S. Precision Engineering, Ltd., who occupy a modern factory on the Hollingbury Trading Estate, Crowhurst Road, Brighton, and supply many well-known companies under contract. A previous article, in MACHINERY, 95/355—26/8/61, it may be recalled, gave some details of machining operations on aluminium die cast frames for the I.B.M. electric typewriter. Other business machine parts which are produced by the company include sets of type with characters of Roman, Cyrillic, Arabic, Hebrew and other forms. Type is currently being produced at rates approaching 100,000 pieces per week, and certain of the methods employed are here described.

TYPE MANUFACTURE

Type is manufactured from swaging-quality mild steel bar, which is purchased in lengths of about 6 ft., cold-rolled to a section comprising a thick central portion and thin side wings, as shown in the sketch, Fig. 1, where the wings are indicated by the dotted outlines. The first operation provides for cutting the bars into lengths suitable for the production of the individual pieces of type and forming the side wings to the shape shown by the full lines in Fig. 1. These operations are performed in the combination tool shown in Fig. 2, which is mounted on a Wells crank-type press of 4 tons capacity, and operates at the rate of 100 strokes per min.

The rolled bar is engaged initially with a pair of grooved feed rollers in a housing at the left-hand side of the lower tool and is subsequently fed automatically. In the feed-roller housing there are apertures in which is guided a vertical square-section plunger, with a cylindrical extension *A* at the top. The extension is secured to a bracket on the top tool so that the plunger is reciprocated with the press ram. On the far side of the lower feed roller there is an integral wheel with a number of ratchet teeth, and these teeth are engaged by a

spring-loaded pawl on the side of the plunger.

As the plunger rises, the pawl engages a tooth and the wheel and roller are turned to feed the stock into the tool by the amount required for one blank. The shaft carrying the upper roller is held in trunnions which slide in vertical slots in the housing, and are spring-loaded downwards so that the roller is pressed against the flat wing extensions of the rolled bar. This pressure also serves to prevent the lower roller from moving back with the pawl as the plunger *A* moves down with the press ram.

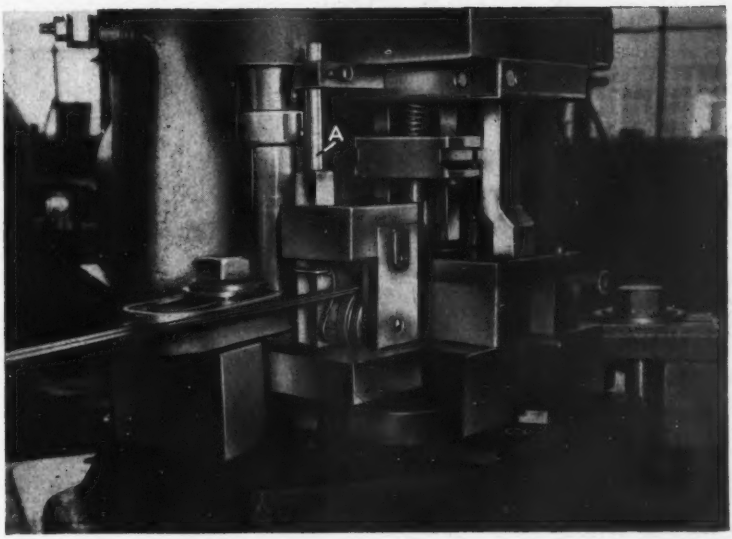


Fig. 2. At this set-up on a Wells 4-ton press, type blanks are produced at the rate of 100 per min.

Further details of the design of the tool can be observed in Fig. 3, where it is seen removed from the press and with the upper portion inverted. From this view, it will be noted that the punch, which crops the bar material to form the end profiles of the blank, is made in two pieces, of similar outline but opposite hand. These pieces are separated by a thin blade which is employed in connection with the forming operation, as will be explained. The two parts of the cropping punch are integral with a mounting flange secured to the face of a sub-plate *B*, which is guided on two cylindrical pillars and held down, away from the main punch plate of the tool, by compression springs.

There are grooves in the long edges of the sub-plate *B*, each with one side normal and the other at 45 deg. to the face, and the upper tool also carries two cranked members *C*, which are pivoted in rectangular apertures in the main punch plate. On the inside of each member there is a projection of section similar to that of the grooves, and these projections are held in engagement with the grooves when the tool is assembled and the press ram raised, as seen in Fig. 2. The stripper plate has two rectangular apertures to receive the ends of the members *C*, and each aperture is formed at an angle of 45 deg. on the sides parallel with the die opening.

With the rolled bar in position in the tool, the press ram moves down, carrying the members *C* with it, until the inclined faces of the projections are in contact with the similarly-inclined faces of the sub-plate grooves. Since the lower ends of the members *C* are prevented by the apertures in the stripper plate from moving outwards, the projections are held in engagement and the sub-plate is then forced down, bringing the split punch into contact with the

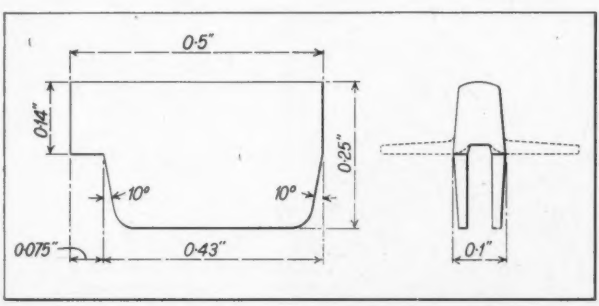


Fig. 1. Views showing the cross-section of the special rolled bar employed for type blanks, and the shape to which the blanks are cropped and formed at the first operation

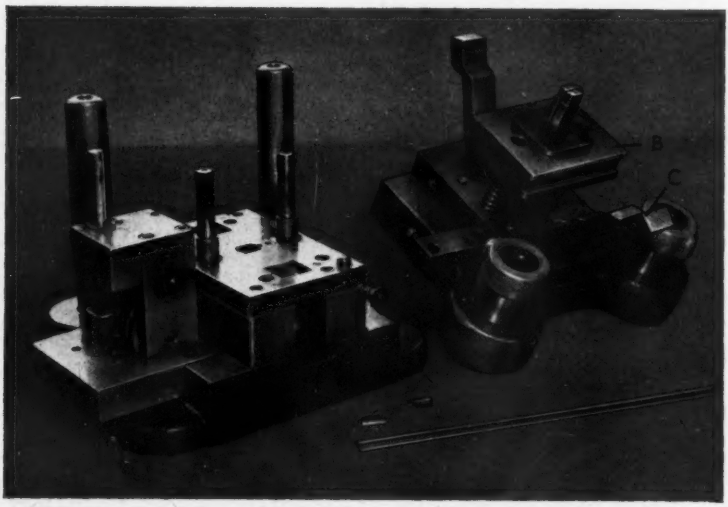


Fig. 3. Further details of the combination tool employed on the press in Fig. 2 may here be seen. The sub-plate *B* is moved down initially by projections on the cranked members *C*

material which is sheared in the die opening. Within this opening there are two forming blades, one at each side of the central thick portion of the rolled bar, which support the thin wings of the cropped blank.

As soon as the blank has been cropped from the bar, the members *C* reach a level at which the cranked portions are opposite the 45-deg. angular walls of the stripper plate openings. These sloping surfaces then act as cams, forcing the member *C* outwards so that the sub-plate is released and is held down only by its springs. Further downward travel of the press ram then moves the central blade down between the cropping punches, pushing the cropped blank further into the die so that it passes between the forming blades mentioned previously, the side wings of the blank being thus bent upwards.

The blank is pushed completely past the forming blades and the side wings expand slightly on the lower side. Consequently, when the press ram is raised, the formed blank is stripped from the punch blade and falls through the opening at the front of the tool. A typical blank is seen at the lower left in Fig. 4, where some of the tooling employed for swaging the characters on the face of the blank may also be observed.

CHARACTER SWAGING OPERATIONS

Characters are swaged on the plain face of the type blank on a special, 6-station, semi-automatic machine of the company's design, which is seen in the heading illustration. The operation is performed in the conventional manner by pressing the face of the blank, with a rolling action, into impressions of the required characters cut in the face of a

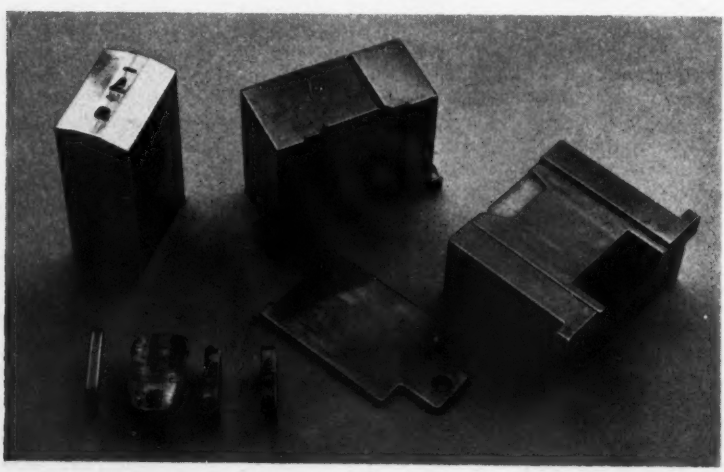


Fig. 4. On the automatic swaging machine seen in the heading illustration, the type blanks are loaded into holders, the three parts of which are shown at the upper right

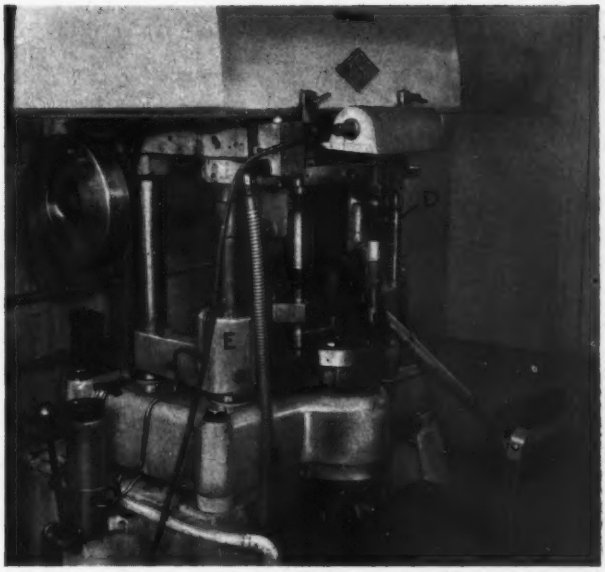


Fig. 5. General view, from the front, of the automatic 6-station indexing machine developed by T. S. Precision Engineering, Ltd., for swaging type characters at the rate of 13 per min.

hard matrix block similar to that seen at the upper left in Fig. 4. There are also cavities in the matrix which form a V-section projection on the blank face, for location during subsequent assembly, and a small triangular trade mark incorporating the company's initials, for later identification, if necessary.

Another view of the type-swaging machine is given in Fig. 5, and it will be seen that it takes the form of a press with a 6-station rotary indexing table. Blanks are placed in position manually, and after each has been pushed down into place, it is carried to a station beneath the ram at which the swaging operation is performed and is subsequently unloaded and discharged automatically. The machine has a heavy cast iron bed, supported on weld-fabricated channel-section legs at each side, and there are bores near the corners in which are secured the cylindrical columns that carry the crown.

There are bearings in the crown, beneath the sheet metal cover, for a heavy horizontal camshaft whereby thrust is applied to the ram during the swaging operation, also for other shafts which are driven through gearing from the 2-h.p. motor. These other shafts serve to drive a crankshaft fitted with a fly-wheel, which provides for the rolling swaging action, also a vertical shaft *D*, to drive a Geneva mechanism for indexing the table.

The crown supports another casting in which there are vertical guide faces for the upper portion of the press ram. Pivoted in the ram is an intermediate member having side pieces to which downward-facing gear segments are secured. The connecting rod from the crankshaft is linked to this intermediate member, which is therefore rocked

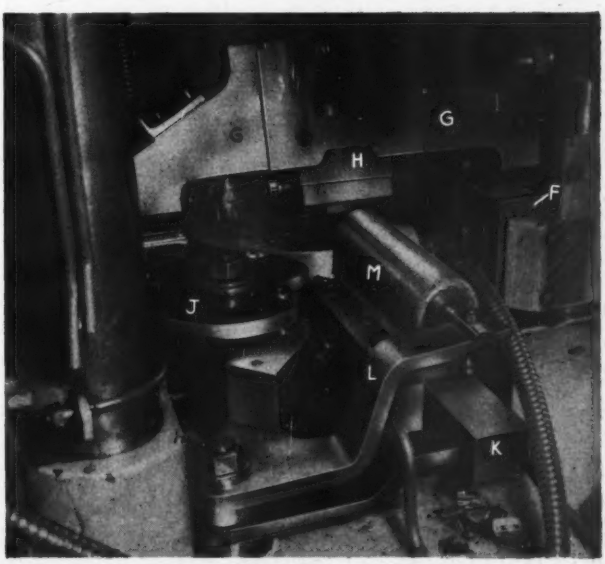


Fig. 6. Close-up view, from the rear, of the automatic type-swaging machine, showing the matrix-holder *H*. During the operation, the holder is rolled in a circular arc of the same radius as the typewriter platen

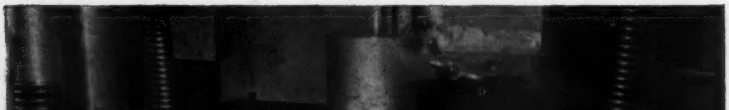


Fig. 7. The automatic unloading plunger, operated by an air cylinder above, carries a pivoted lever *S*, which ejects the workpiece from the jaws *R* when it has been raised to a level opposite the end of the guide tube at the right

about its horizontal pivot when the crankshaft is rotated. Each pair of vertical support pillars for the crown passes through bosses on a vertically-adjustable casting, as at *E*, the front bosses being larger than the rear. These front bosses are positioned at each side of the press ram, and each has guideways in the face adjacent to the ram.

The arrangement is seen more clearly in the close-up view from the rear of the machine in Fig. 6, and each of the guideways houses a vertical slide *F*, which is spring-loaded upwards. On the upper face of each slide there are rack teeth which mesh with the teeth of a gear segment on an extension *G*, secured to the matrix-holder *H*, the arrangement being the same on both sides Upward-facing teeth of a gear segment on the upper face of each extension *G* mesh with one of the gear segments on the intermediate member pivoted to the ram. The action of the mechanism, when the crankshaft is rotating, is to cause the matrix face to move in an arc of a circle, the centre and radius of which coincide with those of the pitch circle for each of the lower gear segments on the extensions *G*. This radius corresponds to that of the platen roller on the typewriter.

Each of the extensions *G* carries a bracket which serves as an anchorage for a strong tension spring and the action of these springs is to pull the ram upwards, the top face being thus held in contact with the cam mentioned earlier. Another cam *J*, is driven from the Geneva indexing mechanism for the table, and serves to advance and withdraw a plunger which provides positive location for the table during the swaging cycle. This plunger is seen at *K*, and it is actuated by the cam through a bell-crank lever, against spring pressure. In the advanced position, the tapered end of the plunger engages one of six similarly-shaped slots in the lower edge of the table, as seen in Fig. 5.

The plunger-operating mechanism incorporates a second lever *L*, which is connected to another plunger in the housing *M*. This plunger has upward-facing air jets at the far end which connect with a central bore, and there is an inlet port at one side. When the plunger is in the advanced position, the port is aligned with a groove within the housing, to which compressed air is supplied through a flexible tube, and the air jets are positioned beneath the face of the matrix. When the groove is aligned with the inlet port, compressed air passes through the bore and emerges from the jets, to blow away any loose material which may be adhering to the matrix face. The plunger thus serves as a control valve for the air blast.

A close-up view showing the loading position of the table is given in Fig. 7, and here the side wings of each blank are inserted in slots in the table surface. These slots are formed by the three components at the right in Fig. 4, and a set of these components is a close fit in a square hole at each of the six table positions. Each set comprises two blocks and a spacer, and a recess is machined in the inner face of each block, also in both sides of the spacer, with a profile similar to that of the wings on the type blank. The three parts are held in place by a wedge, which is tightened from beneath the table by a bolt, and the arrangement is such that the type blanks can be pushed into place under finger pressure.

Each loaded blank is carried to the left when the table is indexed and is positioned beneath a

vertical spring-loaded plunger carried in brackets on the casting *E* in the foreground in Fig. 5. The upper end of the plunger is connected to the press ram, and when the latter moves down, the spring is compressed. Force is transmitted through the spring to the lower part of the plunger which carries a foot *N*, Fig. 7, extending over the freshly-loaded blank. An adjustable screw in this foot is thus applied to the blank, to push it down into the blank-holder as far as it will go.

An idle position follows before the blank is carried into place beneath the ram for the swaging operation. Here, the matrix is moved downwards by the cam while it is being rolled over the face of the blank, in the manner described above, the swaging operation occupying a period of 4·5 sec., during which a total of 24 complete oscillations is made. The press ram then rises, and the table is indexed to carry the swaged blank to a position at which the spacer seen in Fig. 4 is raised from beneath the table by a cam, the blank being thus lifted clear of the table surface.

At the next indexing movement, the blank is carried into place beneath the unloading unit seen at the right in Fig. 7, which is operated by a vertical air cylinder above, mounted on a bracket attached to the press ram guide casting. The piston rod of this cylinder is connected to a cylindrical plunger *P*, which can slide in a bore in the lower part of the mounting bracket and has a key to prevent rotation. At the lower end of the plunger there is a wide slot, which accommodates two pivoted, spring-loaded jaws, as at *R*, and the swaged work is carried into position between these jaws by the indexing movement of the table.

A deeper and narrower slot in the plunger *P*, at 90 deg. to the other, accommodates a pivoted ejector lever *S*, which is held in the position shown by a spring, with the lower end clear of the jaws. When the air cylinder is operated the jaws are closed and raised, and the workpiece is lifted off the spacer and carried to a position opposite the end of the guide tube at the right. As the swaged work reaches this level, the projecting upper end of the ejector level *S* is brought sharply into contact with the lower face of the bracket housing the plunger. This action causes the lever to turn about its pivot. The lower end is thus moved to the right and ejects the swaged workpiece from between the jaws into the guide tube, down which it slides and falls into a container.

From the swaging machine, the workpieces are transferred to the tool shown in Fig. 8, which is set up on a Norton pedal-operated press. This tool has a die with a rectangular opening corresponding to the size of the face on which the characters are to appear on the finished piece of type. The punch incorporates a blade of a thickness that will just enter the slot in the blank, and has side pieces with recesses of the same profile as the wings on each side of the workpiece, to provide for end-wise positioning.

Each piece is loaded by hand on to the blade, where it is retained by the closeness of the fit, and the punch is then brought down to push the work through the die aperture, the excess metal resulting from the swaging operation being thus sheared off. There are two levers *T*, at the sides of the die, so arranged as to ensure that the hands of the operator are in safe positions before the press can be started. Each lever is pivoted in a post, and the outer end is normally held in the raised position by a spring-loaded plunger. The inner end is thus urged into contact with one of the guide pillars of the die set, beneath the bush on the punch plate, and the latter is thus prevented from moving below a certain level. Both levers must be depressed by the operator's hands to bring them clear of the punch plate.

After they have been trimmed, the pieces of

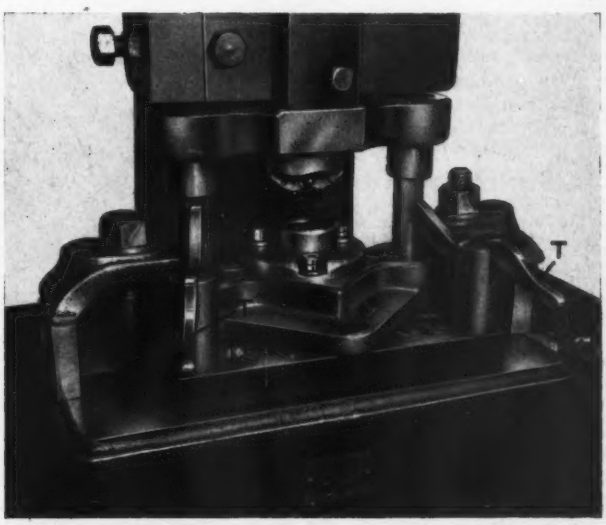


Fig. 8. Excess material, squeezed out during the swaging of the characters, is cropped off on this simple tool which is mounted in a pedal-operated press

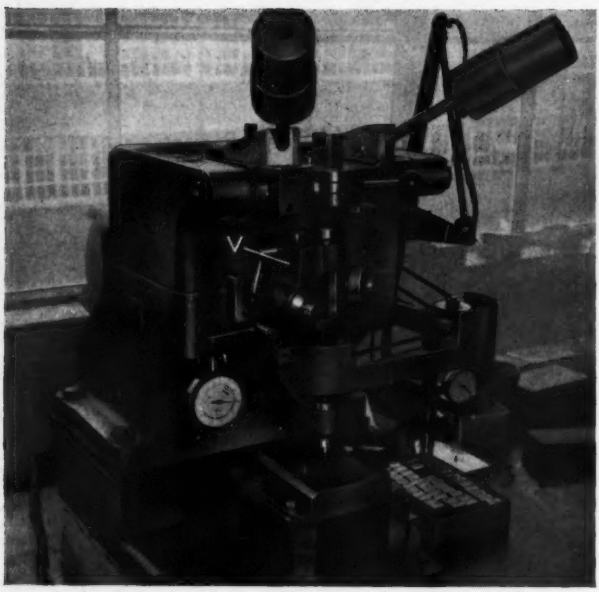


Fig. 9. A general view of the special machine designed for cutting characters in swaging matrices for use in the automatic machine. The bracket *V* accommodates a self-contained spindle unit, driven from a motor at the rear of the machine

type are taken to the heat treatment department where they are cyanide case-hardened to a depth of 0·006/0·008 in., and they are subsequently plated with a 0·0005-in. thick coating of nickel before being delivered to the customer.

MAKING SWAGING MATRICES

Matrices of the type seen at the upper left in Fig. 4 are produced from Balfour's water-hardening die steel, which is first rough machined to dimensions of 0·55 by 0·78 by 1·5 in., and to the end profile shown. The character impressions are then cut on the special engraving machine shown in Fig. 9, which was designed and built by the company. On this machine, brass master plates are employed in which the shapes of the characters have been engraved at 16 × enlargement, and these plates are prepared from drawings, 100 times full size, on Taylor, Taylor & Hobson pantograph engraving machines.

The machine shown in Fig. 9 is of cast iron construction and has a bracket *V* at the front in which a self-contained spindle unit can be clamped. The unit houses pre-loaded ball bearings for a spindle which carries a special Taylor, Taylor & Hobson engraving cutter, having an included angle at the nose end of 72 deg. The complete spindle unit is removed from the machine when the cutter requires regrinding, and the operation is performed with the tool still in the spindle to ensure concentricity of the point with the spindle axis. A cutter grinding machine by Geo. H. Alexander Machinery, Ltd., has been specially modified for this purpose.

In the bracket, the spindle unit can be adjusted vertically, to vary the depth of penetration of the cutter point into the matrix face above, by means of a knurled knob and graduated dial at the front. The dial is marked in divisions corresponding to vertical movements of the spindle unit of 0·0004 in., and it serves to adjust the position of a stop against which the spindle unit housing is thrust by a spring. Movements of the spindle are registered on the Baty dial gauge at the left, which is graduated to match the adjustment dial. After it has been set, the spindle unit is locked in position by a lever and nut at the left-hand side of the bracket.

The spindle is driven at a speed of 8,000 r.p.m., through two circular-section leather belts, an auxiliary spindle being interposed to provide a right-angle drive from a ¼-h.p. motor at the rear of the machine. The second belt drives a short spindle directly beneath the cutter spindle housing, the two spindles being connected by a mortise and tenon coupling which allows for independent movement of the cutter spindle unit, for adjustment.

At the top of the machine casting there are two projecting ears which are bored to form bearings for trunnions on which the matrix holder is pivoted. This holder is seen more clearly in the close-up view in Fig. 10, and it comprises a rectangular block of hardened steel to which the trunnions are attached. At the centre of the front edge there is a deep slot to accommodate the matrix, which is held in position by a pivoted, cam-actuated clamp *W*. The sides of the slot are accurately finish-ground, and serve as locating faces for the matrix blocks.

Slip gauges are employed to set the block in the different positions required to ensure the correct spacing of the location bar, character, and trade mark impressions on the matrix face. To the rear

of the matrix-holder a cranked lever is connected which terminates in the stylus-holder indicated at *X*, Fig. 10.

The pointed stylus in the end of this holder is spring-loaded downwards, to hold it in engagement with the grooves of the character engraved in the brass master plate, which is clamped to the surface of the platform beneath. Two arms carrying counterbalancing weights extend forward from the surface of the matrix holder to balance the mass of material at the rear of the trunnion bearings.

The distance from the trunnion axis to the matrix face is controlled by projections on the underside of the matrix holder, and corresponds to the radius of the platen roller on the typewriter. When an impression is cut in the matrix face on this machine, the bottom, which forms the face of the character whereby the paper is marked on the assembled typewriter, has a constant width corresponding to the radius at the end of the cutter, which is held at 0·002 in. Characters are cut in the matrix face by feeding the cutter into the work and tracing out the impression in the brass-plate beneath. The cutter is advanced into the work by stages to a depth of 0·023 in., and care is taken to ensure that the tool has the required tapering sides of 72 deg. included angle, and the radius mentioned, before the final cuts are taken on the impression.

After the matrix block has been hardened to 64 Rockwell C., and cleaned, it is returned to the holder for a polishing operation on the impressions to be performed. For this work, a spindle carrying a stubby bristle brush is substituted for the cutter spindle, and the brush, which is charged with Cannings rouge polishing composition, is guided round the impression with the aid of the brass master plate. After it has been polished the matrix is ready to be put into service.

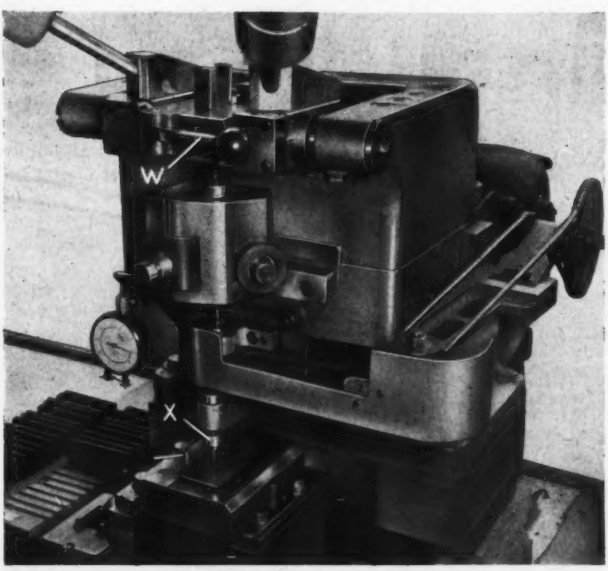


Fig. 10. This close-up view of the engraving machine shows the matrix holder in which the blocks are clamped by means of the lever *W*, above the upwardly-projecting engraving tool in the spindle

Large Cranes for Nuclear Power Station Construction

At the 580-MW. nuclear power station which is now being constructed on behalf of the Central Electricity Generating Board by the English Electric, Babcock & Wilcox, Taylor Woodrow atomic power group at Sizewell, Suffolk, two very large cranes are being erected. One of these cranes is a 250-ft. high, 400-ton capacity Goliath type made by Babcock & Wilcox, which was also used in the building of the 500-MW. power station at Hinkley Point, Somerset.

The second is a 10-ton capacity, free-travelling tower crane made by Norddeutsche Maschinen-und Schraubenwerke A.G., Peine, Hanover, West Germany. At present, the Peine crane is operating at reduced height, but when it is fully erected, the height from ground level to the top of the mast will be 220 ft., and with the lifting boom raised to its extreme limit, the overall height will be 320 ft.

This crane incorporates a hydraulic lifting arrangement which can be employed to raise the mast sufficiently to enable an extra 15-ft. long section to be inserted at the bottom. This operation, it is stated, can be completed in less than three hours.

Electrically operated, with a total of 300 h.p., and with Ward-Leonard control for the hoisting motion, the crane is capable of lifting a load of 5 tons at the maximum radius of 164 ft., and is mounted on its own rails. A second Peine free-travelling tower crane of the same size as that just described, is shortly to be delivered to the Sizewell site.

Developments in Moiré Fringe Measurement Systems*

By A. T. SHEPHERD†

A DIGITAL LENGTH MEASURING system based on the use of moiré fringes produced by optical gratings was developed by Ferranti, Ltd., in 1953. Collaboration with the National Physical Laboratory resulted in the production of suitable gratings in the range 500 lines per in. to 250 lines per mm. With the sine and cosine waveform shown at 3 and 4 in Fig. 1 applied to simple logical circuitry, a pulse output of two or four digits per grating pitch, together with directional information, is obtainable. When used with a bi-directional counting circuit this arrangement formed the basis of measuring systems suitable for a variety of applications, such as continuous path control, co-ordinate positioning, and digitized length measurement. The digit sizes range from 0·001 in. down to 1 micron.

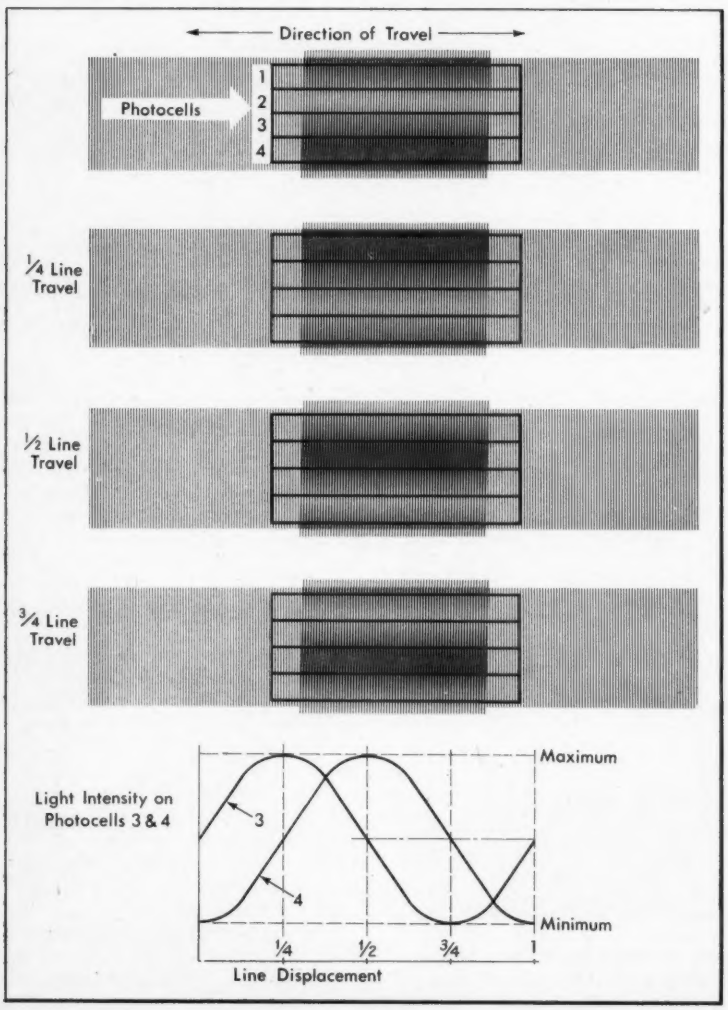


Fig. 1. Moiré fringe and light distribution

More recently, systems have been developed by the Staveley Research Department, and by Ferranti, Ltd., which involve the use of relatively coarse gratings of the order of 100 lines per in., with interpolation to 1/50th or 1/100th of a pitch.[1] Such systems normally require the introduction of a carrier waveform, either by mechanical scanning, or by elec-

* Abstract from a paper entitled "Recent Developments in Moiré Fringe Measurement Systems for Machine Tool Control", presented at The Second International Machine Tool Design and Research Conference, Manchester College of Science and Technology.

† Ferranti, Ltd.

1 See MACHINERY 98/1309—7/6/61

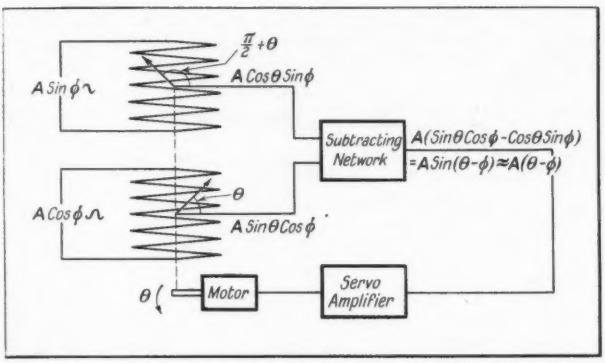


Fig. 2. Phase-following servo system

tronic means, and interpolation is effected in terms of the phase of the grating waveform within one cycle. This arrangement is quite attractive for a continuous path system such as the Ferranti Mk. IV, where the command signal can be made compatible with the grating signal and a phase comparator produces a servo error signal by direct comparison of two waveforms. However, for systems involving purely digital operations, the method is not so attractive. Various complications arise in the datum setting within one cycle and in producing a satisfactory digital output. Subdivision of the cycle into 100 parts also demands a high standard of waveform purity in the grating signal, which cannot always be guaranteed in practice.

The system here described gives digital subdivision to 1/10th of a pitch and could be extended to 1/20th of a pitch without the use of a carrier. With a 1,000-line per in. grating, comparable in cost with one of 100 lines per in., the system affords a digit size of 50 or a 100 micro-inches, which would meet all normal engineering requirements, including jig borer applications. An optical reading unit of the coarse grating type can still be used with 1,000 line per in. measuring gratings, and the working gap is about 0·012 in.

The principle of operation is as follows. If the two grating waveforms $A \sin \phi$ and $A \cos \phi$ are applied to a pair of sine-cosine potentiometers mounted on a common shaft with an angular displacement of θ, the signals obtained from the output wipers will be of the form $A \sin \theta \cos \phi$, and $A \cos \theta \sin \phi$, respectively. If these signals are subtracted electrically the resultant reduces to $A \sin (\theta-\phi)$, or $A (\theta-\phi)$ when the difference is small. This reduced resultant may be used as the error signal of a servo system, which is arranged to rotate the shaft of the potentiometer so that it follows the phase of the grating pitch, as shown in Fig. 2. This method has, however, limitations of speed.

Consider now that the continuously variable potentiometers are replaced by 10-position switches fitted with resistors obeying a sine-cosine law. This arrangement would divide the grating cycle into ten equal steps, but is still not practicable. The final step is to replace the switches by chains of resistors with tapping points, again following a sine-cosine law, the wiper taking the form of a series of electronic switches of which only one is closed on each chain. Since no physical movement is involved, the circular movement of the wiper is replaced by an electronic "wiper" which produces an oscillatory effect. This arrangement results in a reduction in the number of switch steps to 6 and 5 respectively, and the servo-drive

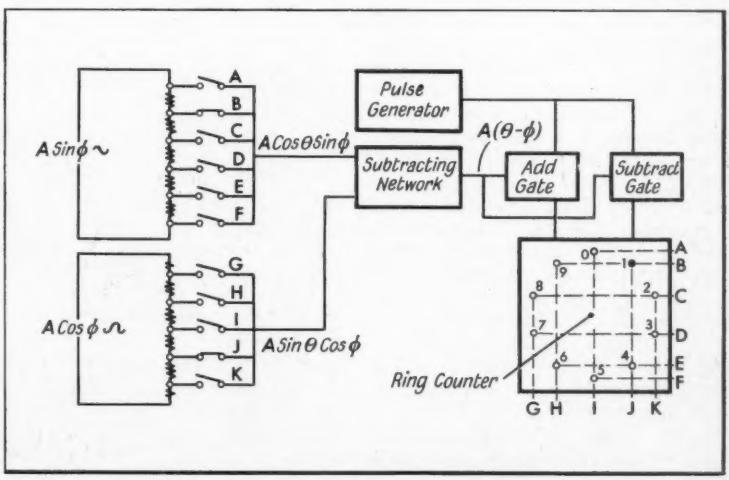


Fig. 3. Arrangement of phase-following counter

motor is replaced, as shown in Fig. 3, by an electronic ring counter with ten steps, of the type already being used in moiré fringe measurement systems.

The " position " of the electronic " wiper " is then determined by the state of the ring counter, each of the ten stages of which, in turn, closes the appropriate pair of switches. If the angular position θ, of the ring counter, differs by more than half a digit or step from the angular position ϕ of the sine-cosine potentiometers, a voltage-operated gate is opened. A pulse from the fixed frequency generator is thereby allowed to change the ring by plus or minus one count, so that the ring counter continually follows the phase ϕ of the grating waveform. A ring of 20 steps associated with a large number of taps on the resistance chain would give subdivision to 1/20th of a pitch, but for most applications 10 is a convenient number. With audio frequency transistors, counting rates in excess of 50,000 per sec. are obtainable, corresponding to a traversing speed of 300 in. per min. with a digit size of 100 micro-inches.

The ring counter may be used as the first stage of a series of decades, but as it cannot readily be re-set to zero, it is more convenient to apply the counting pulses in parallel to a second ring, which can be re-set to zero, while the first ring remains locked to the phase of the input signal. This second ring may also be used to effect a scale change in the first stage which might have to be a ring of 5 if the digit size were, for instance, 2 microns. This method of driving a counter has advantages over that in which counting pulses are generated from the grating waveforms. It ensures that the pulses are accurately shaped and with a maximum frequency well within the capability of the counter. The input circuit also acts as a buffer memory with a capacity of ± 4 digits, so that any mechanical or electrical disturbance which might result in a pulse being lost, or a spurious pulse introduced, is now automatically corrected.

It is customary, for all applications involving metal cutting, and for the more comprehensive measuring installations, to add a check channel which immediately indicates the presence of a circuit fault. This feature may take the form of a single scale of three stages, operating in parallel with the input of the first decade stage. A " divide by 3 " operation is performed continuously on the total number contained in the decade stages, and a comparison of the arithmetical remainder with the number in the ternary stage serves to indicate a fault in the procedure as soon as there is a difference of one digit.

ACKNOWLEDGEMENT

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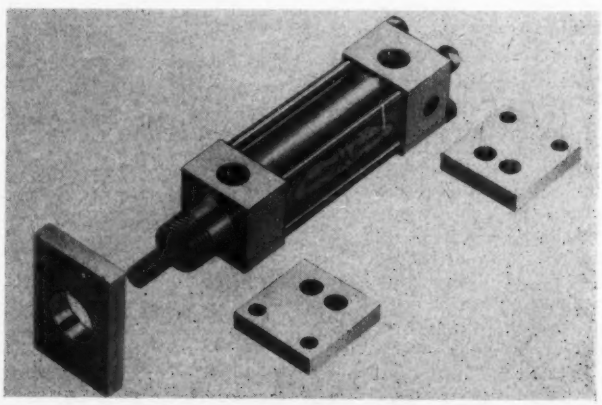
Air Automation Small-bore Air Cylinders

Air Automation, 26 Sharrocks Street, Wolverhampton, Staffs., have recently introduced a new range of square-ended air cylinders of tie-bar construction, the first available having bore sizes of ¾ and 1 in. They can be supplied in single-acting, double-acting, and single-acting spring-return types. These cylinders are very compact and have brass bodies, stainless-steel piston rods, and neoprene distributor-type U-seals for both rod and piston.

Each type is provided with a threaded nose, as shown in the accompanying illustration, and is arranged for front face mounting or rear trunnion mounting. In addition, a front flange mounting plate or foot mounting plate can be supplied, if required.



Air Automation tie-bar type air cylinder which is available with bore sizes of ¾ and 1 in., and with various mounting arrangements

The Automatic Grinding of Ball-bearing Races

High-capacity Plant Installed at the Works of The Hoffmann Manufacturing Co., Ltd.

By S. C. POULSEN, Associate Editor

IN AN EARLIER ARTICLE in MACHINERY, 99/1116—15/11/61, reference was made to the high-capacity plant, comprising 41 machines, which has been installed recently at the works of the Hoffmann Manufacturing Co., Ltd., Chelmsford, Essex, for the automatic grinding of ball-bearing inner and outer races, for bearings with bore-diameters of ⅜ in. to 1½ in., and 15 mm. to 50 mm. This plant is arranged to operate continuously, night and day, five days a week, and the machines are served by automatic feed equipment designed and built by the company. Among the facilities described were the centralized services for the supply of coolant, hydraulic fluid, cooling water, and electric power, and reference was made to some typical set-ups for bore grinding inner races on Bryant Centalign (Buck & Hickman, Ltd.) and Heald 190A (Alfred Herbert, Ltd.) machines. Here, some further set-ups, on other machines in the section, are considered.

As already indicated, the Bryant Centalign and Heald 190A machines are equipped for automatic feed-back size-control. On three of the Bryant Centalign machines, originally installed in a pilot development plant, gauging is carried out on a "post-process" basis, whereas on the remainder, and on the Heald 190A machines, it is on an "in-process" basis. For the latter system, an automatic plug-gauge is incorporated in the work-head spindle, and enters the work bore when the required size is reached, to terminate the cycle. According to whether the plug-gauge enters the bore at an early or late stage during finish grinding, due to the bore being rough ground oversize or undersize, corrective feed-back signals are transmitted to rectify the error on the next component.

TRACK GRINDING INNER RACES

Next to the line devoted to the bore grinding of inner races, there is a line of 10 Landis 4-in. Concentric machines (Landis Lund, Ltd.) which are employed for grinding the tracks. As the ground components are delivered from the bore grinding machines, they are transferred to the track grinding machines by automatic feed equipment of the design described in the preceding article. Here, the tracks are ground to a radius form, within limits of +2½ per cent +3½ per cent of the ball diameter, and typical limits on the major diameter, which vary according to the size of the bearing, are −0·0005 in. −0·001 in. Total stock-removal also varies with size, from 0·010 in. to 0·016 in. on diameter.

The maximum permissible deviation of the major diameter from circularity is 0·00005 in., and on the Landis machines, circularity is readily maintained within 0·00003 in. by means of a special "third shoe" centreless system, in conjunction with a magnetic work-driver. Initially, the bore is located 0·005 in. above the work-head centre, and displaced horizontally, by the same amount, towards the wheel, on two internal shoes. These shoes are arranged 90 deg. apart, at 45 deg. on either side of the point of wheel-contact. This method of support is used for the rough grinding stage, during which the wheel-head is advanced against a stop. On completion of this stage, the third shoe is advanced into engagement with the external surface of the work, at a point diametrically opposite the point of wheel-contact. Continued advance of the third shoe, through a predetermined distance, then feeds the race against the wheel for the finish grinding stage. During this stage, the work "hangs" from the upper internal shoe, which serves as a fulcrum. A timed interval after the third shoe has reached the fully-advanced position, and before the wheel-head is withdrawn, provides the sizing dwell.

WORKING CYCLE

A typical set-up on one of the Landis machines, for grinding the tracks on inner races with a bore-diameter of 50 mm., is shown in Fig. 1. The components are delivered into the hopper *A*, by the automatic feed equipment, and are released, one at a time, into the upper end of the inclined

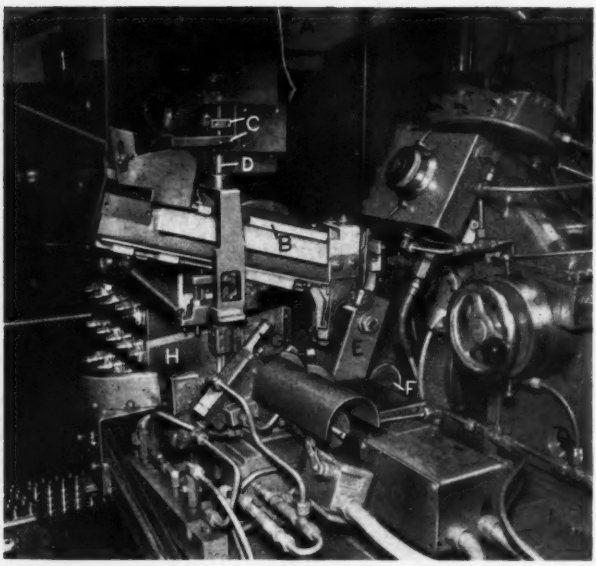


Fig. 1. Typical set-up for track grinding inner races, on one of the ten Landis 4-in. Concentric machines, showing the equipment for automatic loading and ejection of workpieces

chute, *B*, by a pair of detent claws *C*. These claws are mounted on the vertical shaft *D*, which is effectively integral with the chute, and the latter is arranged to turn about the vertical axis, so that the lower end can be swung sideways. When a component is released from the hopper, it descends to the lower end, where it is retained against a locating stop by a permanent magnet. The two main work-locating shoes, and a spring-loaded peg termed the "grinding stud," are mounted on a loading arm *E*. For the grinding operation, this arm is swung forwards and downwards, with the shoes and stud in line with the magnetic driver *F*.

At the end of the cycle, the loading arm is swung upwards and to the rear, away from the wheel, the chute having already been swung to the left, to clear it. Towards the end of this movement of the loading arm, the ground component is slid between the limbs of the hydraulically-operated stripper *G*, which is then actuated. The stripper moves towards the left, to pull the component off the stud and shoes, ejects it into the delivery chute *H*, and returns to the original position. Meanwhile, during the return motion, the loading arm dwells momentarily in line with the fresh component at the bottom of the chute *B*, which is then swung to the right, to engage the component with the grinding stud and shoes. Continued movement of the loading arm then carries the component through an aperture in the magazine, to the grinding position. Immediately the component and arm are clear of the aperture, the chute is again swung to the left, with the result that a fresh component is released into it, from the hopper, in readiness for the next cycle.

Meanwhile, the component on the loading arm is ground in roughing and finishing stages, as already described. During the finish grinding stage, the spring of the stud yields to the thrust of the third shoe, so that the locating function of the shoes is not impaired. All three shoes are provided with carbide pads, to resist wear, and the third shoe, which is mounted pivotally on a stationary portion of the machine, is actuated hydraulically. The magnetic driver is of segmental construction, and is also provided with radially-disposed carbide inserts. A Universal grade A80 KV wheel, of 16 in. diameter by ½ in. wide, is employed, and is run at 1,500 r.p.m. The work speed is steplessly variable up to 500 r.p.m., and the 50-mm. bore races seen in Fig. 1, for which the cycle time is 22 sec., are driven at 350 r.p.m.

AUTOMATIC DRESSING

After each 60th component has been ground, and the loading arm has been raised, the working cycle is interrupted, and the wheel-head is advanced in accordance with the amount to be removed from the wheel during the automatic dressing cycle. The dressing attachment can be pre-set to make any required number of passes up to 80, with controlled increments of feed down to 0·0003 in. per pass. These increments are applied hydraulically, and there is provision in the system for reducing them at a predetermined point, so that dressing can be carried out in roughing and finishing stages.

For the particular wheel dressing operation here discussed, the attachment is set to make two passes, at the first of which 0·0006 in. is removed from the wheel, and at the second, 0·0003 in. After the second pass, the diamond stops in a position clear of the wheel, and the normal working cycles are resumed.

On these machines, it may be noted, each wheel

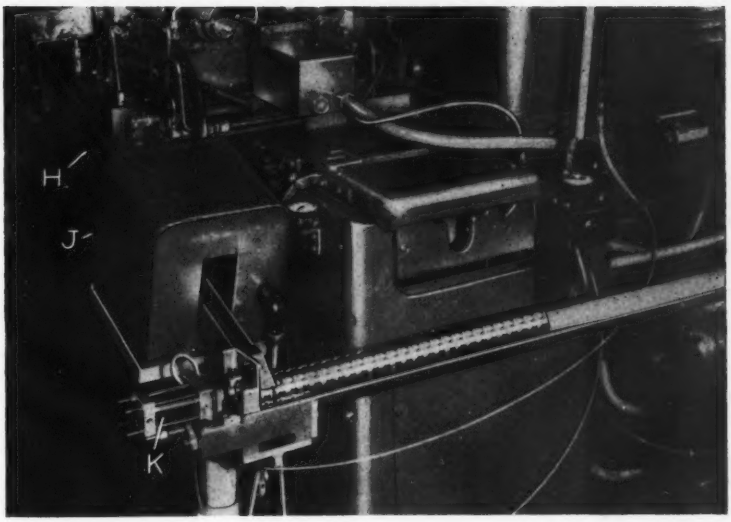


Fig. 2. On each Landis machine, provision is made for automatically stacking the ground components, as here shown, to avoid damage to the tracks by impact

is provided with a flanged adapter, on which it is initially dressed and balanced before it is set-up on the machine. This arrangement offers several advantages, among which may be mentioned ease and rapidity of wheel-changing, for different sizes of work; avoidance of excessive dust-formation, and expenditure of time, at the machine, during the initial radius-dressing of new wheels, or the re-profiling of existing wheels to different radii; and reduced wear on the dressing diamond of the machine.

To protect the ground tracks against damage due to impacts caused by random discharge of the races, stacking equipment of the design shown in Fig. 2 is provided on each machine. As each component travels down the inclined delivery-chute *H*, it passes through a demagnetizing head *J*, and at the bottom, it trips a micro-switch. A double-acting pneumatic ram *K*, which is thus actuated, thrusts the race sideways along a V-section rack, as seen, and is then retracted in readiness for the next component. Stacking of the components in this manner facilitates their removal, by the insertion of a wooden rod through the bores. From the rod they may be readily loaded on to peg-boards, or stacked in vertical columns in metal boxes.

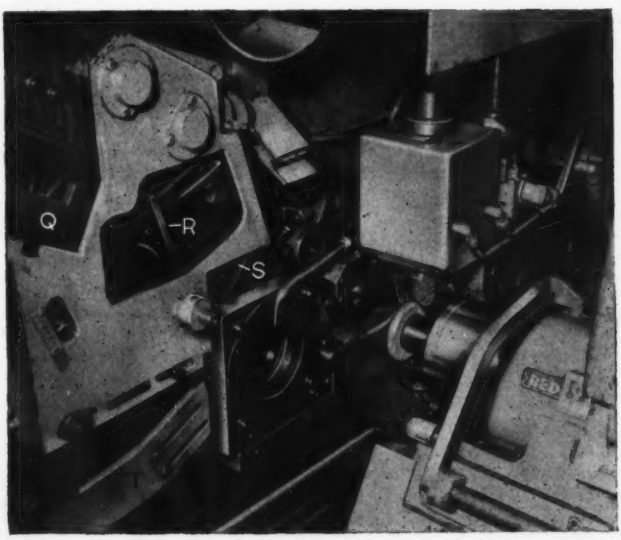


Fig. 3. On the Heald type 1901 machines engaged on track grinding outer races, one of which is here shown, coolant pressure is used for work-clamping

TRACK GRINDING OUTER RACES

For the corresponding operation on the outer races, for which the tolerances on track-radius, major diameter, and roundness are generally similar to those for the inner races, a line of 10 Heald type 1901 Centrimatic machines (Alfred Herbert, Ltd.) is employed. A typical set-up on one of

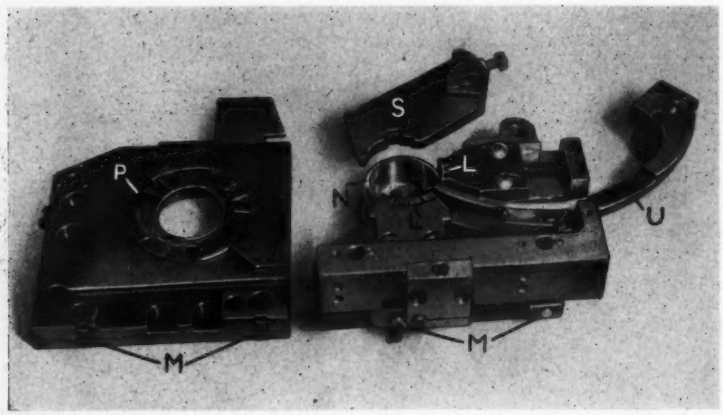


Fig. 4. Typical set of tooling elements for a Heald 1901 machine, showing the principal design features. The datum-pads *M* facilitate pre-setting the assembly in the toolroom

these machines is shown in Fig. 3, and for clarity, the various tooling elements are shown separately in Fig. 4. As mentioned in the preceding article, all such items of tooling are so designed that they can be pre-set in the toolroom, and set-up on the machines without any further adjustment. On three of the Heald type 1901 Centrimatic machines, originally installed in the pilot development plant, the tooling is similar to that on the Heald 190A machines employed for bore grinding inner races, as earlier described. The remainder, however, are equipped as seen in Fig. 3 and 4.

Here, again, grinding is carried out by the "shoe centreless" method, and the two shoes *L*, which are provided with multiple wear-pads of tungsten carbide, are mounted on a Meehanite bracket. This bracket, and a housing plate of similar material, seen at the left, are fitted with flat datum-pads *M*, which provide for locating the assembly, both on the machine, and during pre-setting in the toolroom. The shoes *L* are adjustable independently, and are 90 deg. apart, at positions corresponding to "3-o'clock" and "6-o'clock". They are set 0·005 in. above, and the same amount forward of, the work-head centre, and the work is frictionally driven by an annular member *N*, on the work-head spindle. The work is held against this member by the "live" clamp-ring *P*, which is actuated by the coolant supply pressure, and the working clearance of the clamp-ring in the housing is 0·0007 in., maximum. Clearances of this order are provided for all the coolant-operated clamp-rings used throughout the section, and for this reason, on each machine so equipped, coolant used for this purpose is thoroughly filtered at the machine. On the Heald 1901 machines, Fram cartridge-type filter units are employed.

Like all the other machines in this section, the Heald 1901 Centrimatics are served by automatic feed equipment of the design described in the preceding article. This equipment delivers the components into the magazine *Q*, Fig. 3, at the bottom of which there is a gate *R*, and a spring-loaded latch (not visible). At the beginning of the cycle, when the "acceptor arm" S is raised, it lifts the gate, and the bottom component in the magazine rolls against the latch. On the return stroke, the acceptor arm thrusts the component past the latch, and on to the shoes *L*. Thereupon, the clamp-ring *P* is energized, so that the work is held against the annular driver *N*. With the work thus gripped, and driven frictionally, the wheel is advanced axially to the required depth in the bore, and is then rapidly moved, horizontally, through a short, quick-approach stroke imparted by a hydraulic ram, to within 0·010 in. of the grinding position.

During the three ensuing stages of the working cycle, the movements of the wheel-head are controlled through a feed-screw, and these stages are as follows. First, the initial gap of 0·010 in. is rapidly taken-up by the action of a sensing device termed the "gap-eliminator", which initiates the rough grinding (second) stage immediately contact is established. Rough grinding is carried out, typically, at a feed of 0·001 in. per sec., until the work is within 0·001 in. of finished size, and the feed is then reduced (again, typically) to 0·0005 in. per sec., for the finish grinding (third) stage. When the wheel has reached the final size position, there is a sizing dwell, after which the wheel-head is rapidly withdrawn, the clamp-ring *P* is released, and the ground component is ejected into the delivery chute *T*, Fig. 3, by the curved ejector arm *U*, Fig. 4. This arm is then withdrawn, in readiness for loading a fresh workpiece at the start of the next cycle.

In Fig. 3, the machine is seen set-up for grinding ½-in. diameter ball tracks in outer races with

an external diameter of 3½ in., to a profile tolerance corresponding to +2½ per cent +3¾ per cent of the ball diameter, and to a tolerance of +0, −0·001 in. on the major diameter. Total stock-removal is approximately 0·020 in., and the 2¼-in. diameter Norton grade 19A180-19-VBE wheel is run at 11,000 r.p.m. On these machines, the cycle time ranges from 12 to 20 sec., according to the size of the work, and for the particular example here considered, it is 12 sec.

After every four to eight components have been ground (again, depending on the size) the wheel is automatically dressed. As the wheel enters the bore of the last component to be ground before the dressing cycle is initiated, the attachment slide is advanced through a nominal stroke, plus the dressing increment, which is typically of the order of 0·0015 in. At the end of the grinding cycle, but before the finish-ground component is ejected, the wheel is withdrawn to the position seen in Fig. 3, where it is dressed at a single pass of the diamond. Immediately the pass has been completed, the attachment slide is retracted to clear the wheel-head, the finish-ground component is ejected, a fresh piece is loaded, and the normal automatic cycle is resumed with the rapid axial advance of the wheel into the bore.

HONING THE TRACKS

The ball tracks of the inner and outer races, ground by the methods described, are left slightly undersize to allow for final finishing by a honing process, during which, on races of the size mentioned above, 0·0002 in. to 0·0003 in. is removed on the track diameter. On inner races, this process is carried out on HMC special-purpose machines, each of which is designed to perform the operation on several components at a time, simultaneously, with the work mounted on a mandrel. These machines were described in MACHINERY, 91/1024—1/11/57, and are situated in another section, to which the ground inner races are next transferred.

In the same article, reference was also made to the "pendulum" method, then in use, for lapping the tracks of outer races. For this purpose, each race was held in a rotating collet, and two profiled stones, mounted in a cylindrical holder fitted with a weighted pendulum rod, were hung on the track. The pendulum was kept swinging by the operator, by an occasional light thrust, so that the stones were oscillated in a plane at right-angles to that of rotation. By this simple means, the work speed, stone pressure, and frequency and amplitude of oscillation, were all readily variable to suit the size of race that was being honed.

In view of the unsuitability of the method for fully-automatic operation, however, it has now been superseded, and a line of 10 HMC special- purpose 2-spindle machines is installed in the main grinding section, next to the line of Heald 1901 Centrimatic track grinding machines. The ground components are fed automatically from the track grinding machines to the honing machines, and a close-up of the working zone of one of the latter is given in Fig. 5. In this view, the machine is seen in the loading position, with the stone holders *V* retracted to clear the hydraulically-operated collet-type chucks.

As may be observed, the holders are carried on a pair of curved limbs *W*, which are arranged to oscillate about a common horizontal axis *X*. This oscillatory motion is imparted by a geared electric motor, through a variable-throw crank, a connecting-rod, and the arm *Y*, which is attached to the horizontal shaft. The complete head assembly,

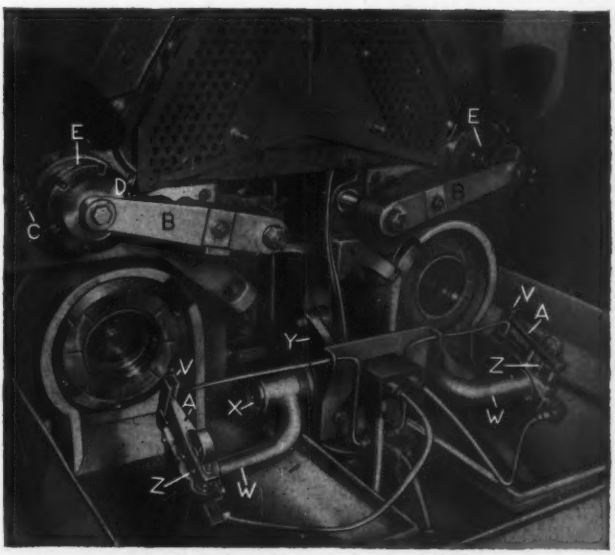


Fig. 5. View of one of the HMC 2-spindle machines for honing the tracks of outer races, with the honing head withdrawn. The stones are arranged to oscillate about the common axis *X*

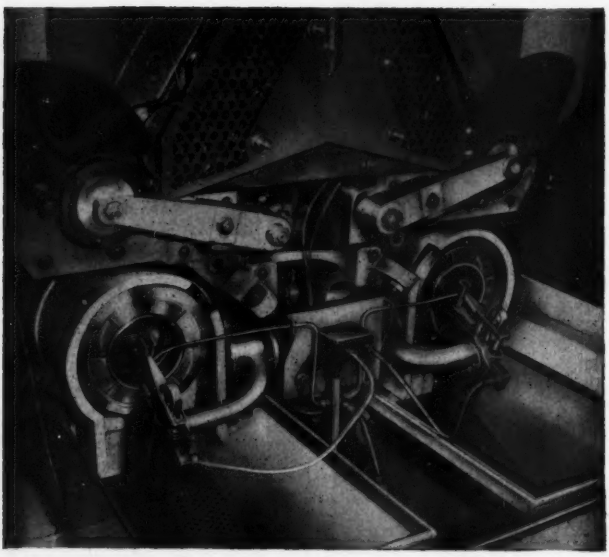


Fig. 6. View showing the honing head in the working position, with the stones engaged with the tracks. Work-speed and rate of stone oscillation are changed automatically

including the motor and oscillating mechanism, is mounted on a vertical hydraulic ram, whereby it can be raised and lowered, and it is also arranged so that it can be moved horizontally. Associated with each stone holder, there is a small hydraulic ram Z, whereby mechanical pressure can be exerted, through the arm *A*, on the upper end of the stone, to thrust the profiled lower end against the revolving work. Each holder is designed to retain the stone by friction, by means of a light wire spring clip, and internal flat spring blades, in such a position that the centre of the radius profile lies on the common horizontal axis *X*. The spring blades also serve as readily-replaceable wear-strips, and for this reason are turned-over at the upper ends, and flanged at the lower, for location by the ends of the holder.

THE AUTOMATIC CYCLE

The automatic feed equipment that conveys the ground outer races from each track grinding machine to the associated honing machine delivers them into the apex of a magazine of the inverted-vee design, seen at the top in Fig. 5. Each limb of the magazine terminates above a "pick-off" position, which is in line with a transfer arm *B*, when the latter is raised, as seen. At each "pick-off" position, there is a set of locating stops, one of which may be observed at *C*, and at the bottom of each limb, there is a detent finger *D*. This detent finger operates in unison with the transfer arm, to release one component at a time on to the locating stops. During the working phase of the cycle, each transfer arm is moved axially towards the headstock, so that a plug *E*, at the outer end, is advanced into the bore of the component at the pick-off position. Each plug is provided with radially spring-loaded fingers, which lightly grip the bore.

At the end of the working cycle, when the honing head is retracted to the position seen in Fig. 5, the chucks are stopped and opened, and each of the honed components is ejected into a delivery chute. Next, the transfer-arms move away from the headstock, each thus withdrawing the fresh component from the locating stops at the pick-off position. The arms then swing downwards, into line with the spindles, and advance towards the headstock, to insert the components in the chucks. Once the chucks have been closed, to grip the components, the movements of the arms are reversed, and they return to the pick-off positions. Here, meanwhile, another component has been released on to each set of locating stops, by the operation of the detent mechanism.

Immediately the transfer-arms are clear of the chucks, the latter are rotated, and the honing head is advanced towards the headstock, until the stones are vertically above the tracks. The head is then lowered, to the position shown in Fig. 6, to engage the stones with the tracks, in which position the common horizontal axis *X* coincides with the centres of the track radii. With the rams Z energized, to apply the honing pressure, the stones are now oscillated about the common axis. Honing is carried out in roughing and finishing stages, involving slow work-rotation with rapid oscillation, followed by rapid work-rotation and slow oscillation. Different combinations of work-speed, grade and hardness of stone, and rate of oscillation, are employed, according to the size of the work.

As a general rule, the smaller components are honed with harder, and the larger with softer stones. Typically, tracks for ¼-in. balls, in races for bearings with a bore-size of ½ in., are honed with Norton grade 37c-500 stones, with a hardness

value of 60 to 70 Rockwell, whereas the Universal grade WA60 stones used on ¼-in. ball tracks, in races for 3½-in. bore bearings, have a hardness value of 30 to 40 Rockwell. At the set-up shown in Fig. 5 and 6, for tracks in the latter category, the work is initially run at 150 r.p.m., and during the first 15 sec. of working contact, corresponding to the roughing stage, the stones complete 35 oscillations. The speed is then increased to 1,400 r.p.m., for the finishing stage, which is of 12 sec. duration, and in this period, the stones perform 7 complete oscillations. Thereupon, oscillation ceases, the rams Z are de-energized, the honing head is raised and withdrawn, and the chucks are stopped and opened for ejection and reloading, in readiness for the next cycle. At this particular set-up, the cycle-time is 35 sec.

On these machines, the cycle-times range from 28 sec. to 50 sec., according to the size of the work, on which the standard of surface-finish maintained is within 3 to 5 micro-inches, r.m.s. The timing of the various functions is controlled by cams, and the cycle-time of each machine is normally adjusted to balance that of the corresponding track grinding machine. Each honing machine incorporates a self-contained automatic lubrication system, and full protection is afforded by a variety of safety cut-out devices. These devices include systems for stopping a machine automatically when the stones wear under-size, and for illuminating a signal-lamp when it is stopped for this, or any other reason. Adequate visual warnings of this type are particularly necessary, since, during any given shift, each machine-line is tended by only one machine-minder and one setter, with one "trouble-shooter" for the entire section. Throughout the section, therefore, all machines are equipped in this manner.

Indexing Drive for the Brooke Centre-column Rotary Transfer Machine

ON THE CENTRE-COLUMN ROTARY TRANSFER MACHINE built by Brooke Tool Automation, Ltd., Aldridge Road, Perry Barr, Birmingham 22b (see MACHINERY, 99/553—6/9/61), drive for indexing the annular work-table is taken from an electric motor, through reduction gearing, and finally by a pinion which meshes with a large-diameter spur gear secured to the lower surface of the table. During the indexing cycle, the table is supported by compressed air so that friction is reduced, and runs on three equally-spaced rollers at the centre of the bed. One of these rollers is just visible at *A* in the close-up view Fig. 1. The rollers are so positioned radially that when the table is located centrally at the end of the indexing cycle, by a patented arrangement which will later be described, there is a small clearance between their peripheries and the table bore.

During the final stage of the indexing cycle, the table speed is automatically reduced, and a plunger in the base, near the periphery of the table, is moved upwards by compressed air. This plunger is shown in the raised position at *B* in the close-up view Fig. 2. The table continues to be rotated until an adjustable stop, as at *C*, makes

Fig. 1. The annular work-table on the Brooke rotary transfer machine is located centrally at each indexing position by three slides, as at *D*, which are moved outwards into engagement with the bore

contact with the plunger, as shown. The table is now set within 0·010 in. of the required position, and the plunger *B* is next moved downwards clear of the stop *C*. Three rectangular-section slides at the centre of the bed, as indicated at *D* in Fig. 1, are then moved radially outwards by the action of a tapered plunger, so that their outer ends make contact with the bore in the table. In this manner, the table is accurately located centrally without play. Subsequently, another plunger, as shown at *E* in Fig. 2, is moved upwards to be passed between a pair of diabolo-shaped rollers carried on a bracket which is secured to the table, for accurately locating the latter for angle. Finally, the compressed air supply is turned off, and the table is then supported by the bed-ways, and is clamped hydro-pneumatically.

Stops and roller assemblies can be provided to give different numbers of indexing positions from 2 to 10. They are secured by bolts which engage with a T-slot round the periphery of a downwardly-projecting portion near the edge of the table. For setting up, the table is accurately located for angle with the aid of optical measuring equipment, and the stops and roller assemblies are then adjusted and secured in the required positions. The individual rollers are mounted on eccentric spindles, so that they can be set to engage the plunger *F* closely, to ensure accurate indexing, without play, and to facilitate initial setting with the optical equipment.

Unit heads for drilling and other operations can be mounted vertically on individual saddles, which are secured by T-bolts to the cylindrical column of the machine. With this arrangement, different numbers of unit heads can be fitted, depending upon the operations to be carried out on the work, and they can be set in various positions to suit the indexing angle. There are circular T-slots in the top surface of the table to enable work-holding fixtures to be set in various positions to correspond with those of the unit heads. Circular T-slots are also provided in the lower surface of the bed and in a floor ring, and support legs, to which wing bases for horizontal-spindle heads may be fitted, can thus be set in various positions as required, to accommodate different types of workpieces.

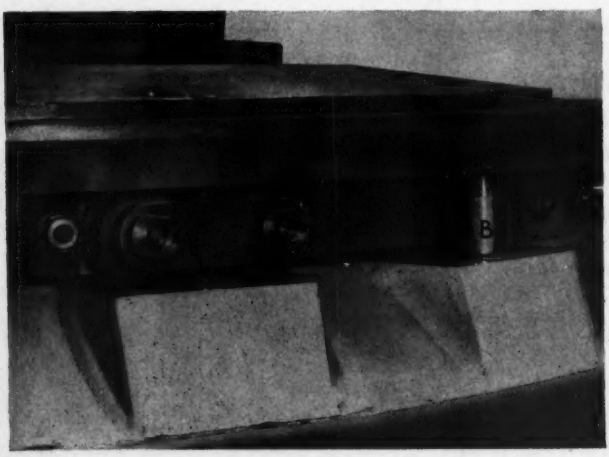


Fig. 2. The plunger shown at *E* in this close-up view, is passed between a pair of diabolo-shaped rollers for accurately locating the table at each indexing position

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CROMCOTE PROCESSES. The Walterisation Co., Ltd., Waddon Marsh Way, Purley Way, Croydon, Surrey, have now introduced the Cromcote B.R. chromate conversion treatment for the surfaces of brass and other copper alloy components, as a means of preventing tarnishing. The parts to be processed, which should be free from grease, are immersed in the treatment bath for a period of 1 to 3 min. at room temperature. They are then rinsed and thoroughly dried at not more than 90 deg. C. The bath is made up of one part of Cromcote B.R. to 25 parts of water, and the chemical consumption in operation is approximately ¾ gm. of concentrate per sq. ft. of surface treated.

In addition, two new treatments for zinc and galvanized steel surfaces have been developed. That known as Cromcote Z.C. is normally applied for corrosion protection and paint bonding, one part of the chemical being diluted in 25 parts of water. The work, which must be free from grease, is treated in the bath for about 1 min., at room temperature, to produce a colourless film which has satisfactory properties. A gold coloured film may be obtained by increasing the immersion time to 3 min., but the paint adhesion properties of this film are inferior.

The second treatment, known as Cromcote Z.H., is a special development of the Z.C. process intended for application to newly galvanized work. The steel parts which have been galvanized may be quenched directly into the Cromcote Z.H. bath.

INDUSTRIAL BUILDING PROJECTS to a total of 509 were approved during the third quarter of this year, and represented an area of 10,523,000 sq. ft.

NEW PRODUCTION EQUIPMENT

Edited by
G. W. Mason
and
A. J. Barker

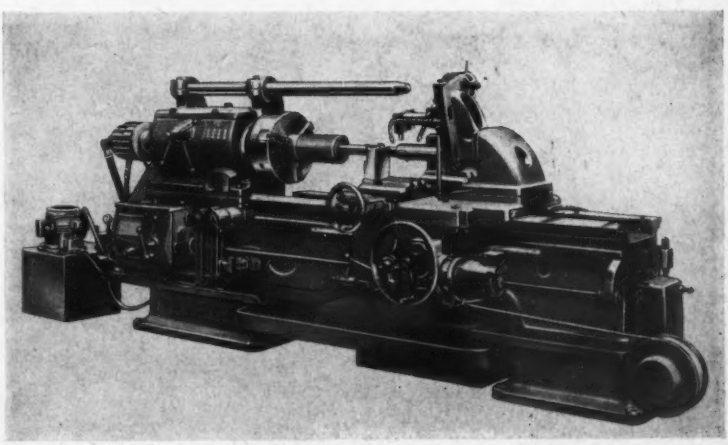
Crowthorn 10½-in. Type H.D. Turning, Boring and Parting-off Lathe

Recently built by The Crowthorn Engineering Co., Ltd., Atlas Works, Reddish, near Stockport, Cheshire, the 10½-in. type H.D. turning, boring and parting-off lathe shown in the figure is intended for repetition machining of such components as cylinder liners, also for operations on ferrous and non-ferrous bars and tubes. It will swing diameters up to 21 and 13 in. over the bed-ways and the saddle, and if required, the bed can be of the gap type, to enable diameters up to 36 in. to be swung.

A total of 12 spindle speeds from 16 to 453 r.p.m. is normally obtainable, and drive is taken through V-belts from a 12-h.p. motor, mounted on slide rails at the back of the bed. A hydraulically-operated clutch of patented design is incorporated in the headstock pulley, and a brake is provided. At extra cost, a high-speed headstock can be provided, which incorporates shaved gears and, with a 2-speed motor, enables spindle speeds ranging from 10½ to 604 or 14 to 806 r.p.m. to be obtained. The spindle runs in two opposed, pre-loaded Timken precision taper roller bearings, with a plain roller bearing at the rear, and is bored 3⅝ in. diameter. A Pratt 16-in. hydraulically-operated 3-jaw chuck is carried on the nose, which is of the American A1, 11-in. short-taper type, and pressure fluid is provided by a separate pump unit, which also supplies the headstock clutch.

A range of 40 feeds from 12 to 160 cuts per in. is obtainable for the sliding and surfacing motions from the quick-change gearbox. Drive for these motions is transmitted through oil bath-lubricated worm gearing in the saddle apron, which is of double-wall, box design. For rapid power traverse of the saddle, a separate motor is flange-mounted on the apron. Adjustable stops are provided for disengaging feed and rapid traverse at predetermined points, and there is also a mechanism whereby rapid traverse is applied following the disengagement of feed.

The bed, which is a semi-steel casting and measures 10 ft. 3 in. long by 18¾ in. wide, has inverted vee and flat ways for the saddle, which are normally hand-scraped. At extra cost, however, lathes can be supplied with induction-hardened and ground ways. Separate T-slotted cross-slides, with single tool-holders, are carried at the front and rear of the saddle, and can be operated simultaneously, for movement either in unison or towards or away from the workpiece, or independently. The heavy-duty boring bar bracket mounted at the right-hand side of the saddle will support a 3¼-in. diameter by 4-ft. long boring bar, which has a pilot nose to enter a bush in the spindle, and it carries a Herbert knee-type tool, with an adjustable holder.



Crowthorn 10½-in. type H.D. turning, boring and parting-off lathe

G1

The coolant equipment includes two motorized pumps, with capacities of 8 and 25 gal. per min.

Tinius Olsen Lo-Torq Torsion Testing Machine

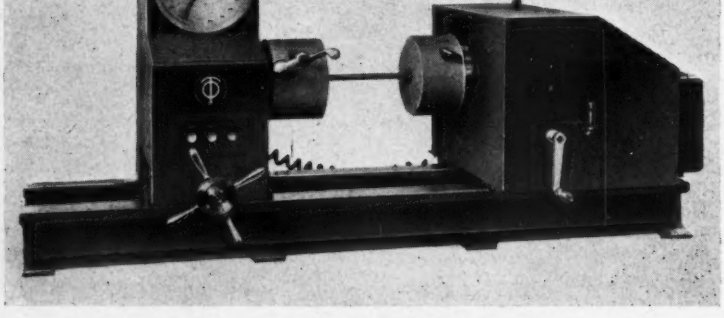
In the accompanying illustration is shown the Lo-Torq torsion testing machine which has been developed by the Tinius Olsen Testing Machine Co., Willow Grove, Pa., U.S.A. It is intended for instructional purposes in technical colleges and universities, as well as for the production testing of wire and other specimens in industry.

Normally, the machine is built with a maximum torsion capacity of 10,000, 5,000, or 2,000 in.-lb., and it will take specimens up to 1-in. diameter and 18 in. long. It is arranged for hand operation, also for single-speed motor drive. Hand operation is used when accurate torsional yield strengths and torsion stress-strain curves are required. The motor drive, which can be engaged at any time, gives a rotational speed of 180 deg. per min., for testing to destruction, or for production testing. As an alternative, an electronically-controlled motor giving steplessly-variable speeds from 5 deg. to 180 deg. per min., can be provided.

Of the 3-jaw type, the specimen-holding chucks are graduated in deg. for determining angles of twist, and testing is carried out in one direction of rotation only. The load is weighed by torque bars and is mechanically indicated on a 10-in. diameter dial. On the standard machine, two reading ranges, to full or to one-tenth capacity, can be selected.

A special ElecTOmatic Lo-Torq machine, with a 28-in. diameter load indicating dial, and four range capacities up to 10,000 in.-lb., is also available. This machine is arranged for motor drive only, and has steplessly-variable speeds from 5 deg. to 180 deg. per min.

Edward G. Herbert, Ltd., Atlas Works, Levenshulme, Manchester, 19, represent the Tinius Olsen Co. in Great Britain and Ireland.



Tinius Olsen Lo-Torq torsion testing machine

Polish ATL 40 Single-spindle Turret-type Automatic

The Polish-built ATL 40 single-spindle turret-type automatic, here shown, which is being marketed by Times Machinery Co., Ltd., Poyle Road, Colnbrook, Slough, Bucks., normally has capacity for bar up to 1½ in. diameter, but if manually-operated feeding equipment is employed, the capacity can be increased to 1¾ in. diameter. The maximum length of bar that can be advanced during each feed movement is $3\frac{15}{16}$ in. Threads up to 1⅜ and 1½ in. diameter, respectively, can be cut in steel and brass by the use of dies, and a thread-chasing attachment is available which has a maximum capacity of 1⅛ in. diameter.

The machine is designed to permit the maximum advantage to be taken of tungsten carbide-tipped tools. A total of 20 spindle speeds, from 422 to 2,040 r.p.m., for turning, and from 53 to 510 r.p.m. for threading, is obtainable by means of four pairs of change gears when the motor is connected to a 50-cycle a.c. electrical supply. In addition, further gears can be supplied to enable a range of lower speeds to be obtained. From the motor, which is of about 6 h.p., drive is taken through reduction gearing, thence to the spindle by two roller chains. The chain sprockets are connected to the spindle by means of a double-acting clutch to provide for driving the spindle at a higher speed for turning or at a lower speed in the opposite direction, for threading. The spindle is mounted in a double-row, precision roller bearing at the front end, and in two plain ball bearings at the rear, and adjustment is provided for taking up axial and radial play.

Normally, there are tool-holes of 25 mm. (0·984 in.) diameter in the $5\frac{33}{32}$-in. diameter, 6-station turret, but holes

of 1-in. diameter can be provided on request. Tools may project a maximum distance of 7½ in. from the turret axis. The turret head has a maximum travel of 3⅜ in. along ways provided on a cast-iron slide member which is bolted to the main bed, and the maximum and minimum distances obtainable between the turret and the spindle nose, are 7½ and 2⅝ in. Horizontally-mounted front and rear cross-slides are provided, and if required, two additional slides can be mounted in inclined positions, above the spindle axis, as shown. Each of these slides has a working travel of 1¾ in., and there are adjusting screws and graduated scales to facilitate setting the cutting tool and the slide assembly.

Polish ATL 40 single-spindle turret-type automatic

Cams for operating the cross-slides, also trip drums to control the non-cutting motions, such as single or double indexing of the turret, for example, are carried on a shaft which extends along the front of the machine, and is driven through change gears from the backshaft. With the standard arrangement, the change gears supplied enable cycle times ranging from 4 to 360 sec. to be obtained, but provision can be made for these times to be doubled. The backshaft is driven through a roller chain and an overload clutch from the main-drive reduction gearing, and it carries the clutches for opening and closing the collet, bar feeding, operating the spindle clutch, and rapid withdrawal, indexing, and rapid advance of the turret. From the backshaft drive is also taken for the 2-speed drilling unit, which can be mounted at any of the turret stations. Drive to the backshaft is automatically disengaged when the bar that is being machined is exhausted.

A coolant system, with a ⅜-h.p. motor-driven pump, is incorporated, and the machine, which weighs approximately 1¾ tons, occupies a floor space of 5 ft. by 2 ft. 3 in. In addition to the items mentioned previously, the extra equipment that is available includes a "silent" stock support tube and pedestals, a slotting attachment, a work transfer unit for use with the latter equipment, and a lamp.

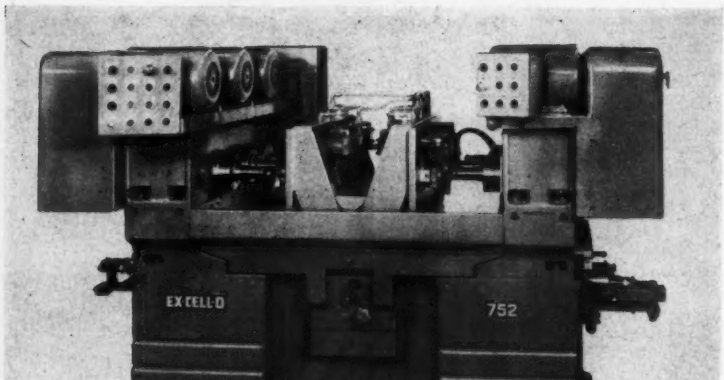
Ex-Cell-O Type 752 Double-ended Boring Machine for Connecting Rods

The Ex-Cell-O Corporation, Detroit 32, Michigan, U.S.A., have recently built the type 752 double-ended machine here illustrated, for semi-finish boring and chamfering operations on both sides of the big ends of motor-car engine connecting rods.

Three workpieces, held by hydraulically-operated latch-type clamps, are accommodated at each side of the fixture, the parts being loaded and unloaded at one side while machining is being performed on the rods at the other. Each rod is located from the gudgeon pin hole, and radially from previously-machined faces on the outside of the bearing cap at the big end, which are engaged by adjustable stop screws.

When the starting button is pressed, the table moves rapidly to the cutting position, and then slows down for the feed stroke, towards the end of which one side of the hole is chamfered. Upon completion of the stroke, the table is retracted rapidly through a short distance, and hydraulically-operated back chamfering tools in the three bars are fed outwards to chamfer the opposite side of each hole.

When these chamfering tools have been fed to depth, they are automatically retracted. Provided that the loading of fresh workpieces at the opposite end has been completed, and the start button pressed again, the table automatically moves in



Ex-Cell-O type 752 double-ended fine-boring machine for connecting rods

rapid traverse to the other end of the bed, and the machining cycle is repeated. If the start button has not been pressed, the table comes to rest in the central position after the three components have been machined. It is stated that an output of 600 pieces per hr. can be obtained from this machine.

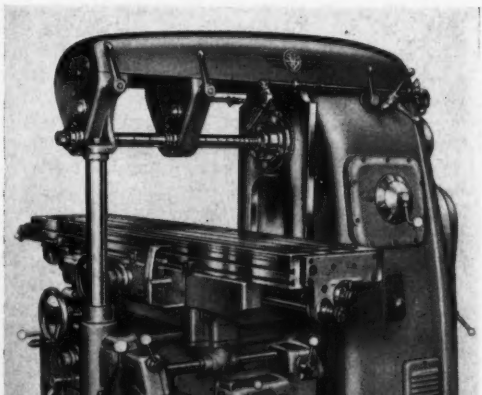
The associated company in this country is Ex-Cell-O (England), Ltd., Hastings Road, Leicester.

Pedersen Type VPU 4A Universal Milling Machine

The range of machine tools built by Vilh Pedersen, Ltd., Hoeng, Denmark, includes the type VPU 4A universal milling machine shown in the accompanying illustration, which has a table with a working surface measuring 63 by 14 in. Drive to the spindle is taken from a flange-mounted motor of 15 h.p., through an electro-magnetic clutch and brake unit, and V-belts, to a gearbox which provides 18 speeds, normally ranging from 30 to 1,500 r.p.m. If desired, a lower speed range, from 23·6 to 1,180 r.p.m., or a higher range, from 37·5 to 1,900 r.p.m., can be provided. The nickel-chromium steel gears have hardened and ground teeth, and the spindle speeds are selected on a single dial.

Precision anti-friction bearings are provided for the heat-treated and ground spindle, and the front arbor support can be connected to the baseplate by means of a column. The knee can be clamped to this column as well as to the guideways of the main column. Provision is made for moving the overarm back on the column, after removal of the arbor supports.

Sixteen rates of power feed, from $\frac{5}{8}$ to 41¾ in. per min. longitudinally and transversely, and from 0·1 to 13¾ in. per min. vertically, are available, also rapid traverse at the rate of 126 in. per min. longitudinally and transversely and 42 in. per min. vertically. The box-type knee houses all the feed gears and electro-magnetic clutches, and the drive is provided by a flange-mounted 3-h.p. motor. Longitudinal, transverse and vertical traverse movements of 44¾, 12⅝ and 19 in. are obtainable, and the table feed screw and nut have provision for the elimination of backlash, to enable both conventional and climb milling to be performed. A swivel adjustment of 45 deg. to either



Pedersen type VPU 4A universal milling machine

side of a zero position is provided for the table.

A joy-stick lever controls the direction of motion, and if the lever is moved fully in, the feed drive and main spindle are stopped. Push-button controls for the motors are provided on each side of the column, and a selector switch, in conjunction with adjustable table dogs, enables a variety of automatic cycles to be obtained. Provision is made on the table and cross saddle for fitting dial indicators and length gauges to facilitate accurate setting.

A coolant pump is incorporated in the base, and additional equipment which can be supplied includes a universal dividing head, a vertical milling attachment, a circular milling attachment, two types of vices, an adjustable angle plate, a crane unit for handling the heavier attachments, and a 24-volt lamp. The machine weighs approximately 3 tons, and it may be noted that a plain version, known as the type VPF 4A, with a 73¾-by 16-in. table, is also available.

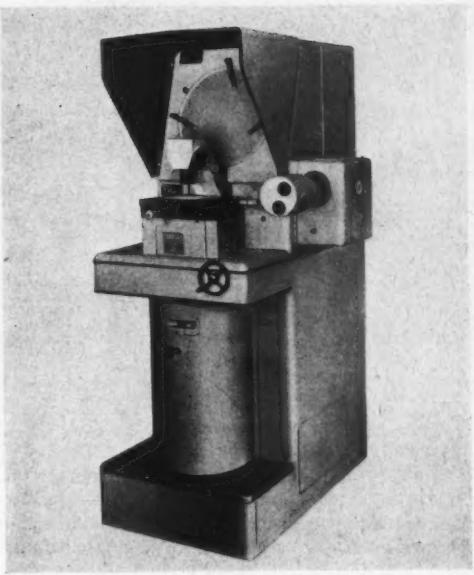
The sole agents in this country for Pedersen milling machines of the size here described are Kavanagh O'Moore & Co., Ltd., 1a Aldred Road, West Hampstead, London, N.W.6.

O.M.T. 15-in. Universal Optical Projector

The 15-in. universal projector seen in the figure is the latest addition to the range of optical inspection equipment made by Optical Measuring Tools, Ltd., Maidenhead, Berks. It is primarily intended for checking templates, cams, gears and screw threads, for example. Because an episcopic projection system is employed, however, which is said to provide an extremely accurate and well-defined image, blind holes, recesses, and cavities produced by die-sinking can also be examined. The 15-in. diameter rotary protractor screen is graduated in degrees, and can be adjusted to within 1 min. of arc by means of a vernier arrangement.

Magnifications of 10, 20, 50, and 100 × are obtainable, and to permit changes to be made rapidly and without the need for re-focusing, the optical system incorporates the company's unity relay lens system. With the latter, individual gauge projection lenses are mounted in a turret, to enable them to be brought quickly to the working position, and the arrangement is such that the distance between the component under inspection and the front lens in the optical system is constant. Provision is made on the turret for the attachment of an additional lens, to suit special requirements.

A vertical adjustment of 5 in. is provided for the compound table, which has a working surface measuring 20 by 8 in., and co-ordinate movements in the horizontal plane, over maximum distances of 6 and 2 in., are applied by means of precision screws. Micrometer drums are mounted on these screws, and settings can be made to an accuracy of 0·0002 in.



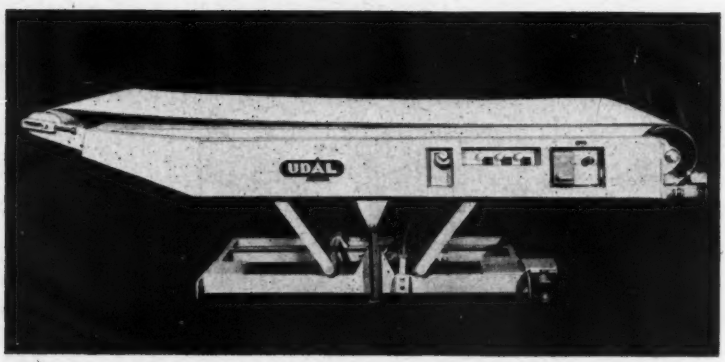
O.M.T. 15-in. universal optical projector

Equipment made by Optical Measuring Tools, Ltd., is marketed by Newall Group Sales, Ltd., High Street, Old Fletton, Peterborough.

Udalveyor Inter-press Conveyor

J. P. Udal, Ltd., Interlock Works, Court Road, Birmingham, 12, have introduced the Udalveyor inter-press conveyor seen in the accompanying illustration. Originally designed for use in the press lines of a leading manufacturer of motor car bodies, this conveyor has now been made generally available.

The standard type is 12 ft. 6 in. long, with a 42-in. wide belt, which runs at a speed of 60 ft. per min. The length, width and speed of the belt, however, can be readily varied to suit individual requirements. A wide range of height adjustments are provided, and when the belt is horizontal, the height from top of belt to floor may range from 25 to 40 in. The height of the belt at the receiving end can be varied from 18 to 48 in., and at the drive end from 20 to 50 in.



Udalveyor inter-press conveyor

Height adjustment is by a foot-operated hydraulic system, and there are no projections on either side of the unit, apart from the gearbox, which is readily accessible to facilitate changing the belt speed. An over-run stop and ample clearance at the receiving end between the belt and the main frame are provided to ensure adequate component protection.

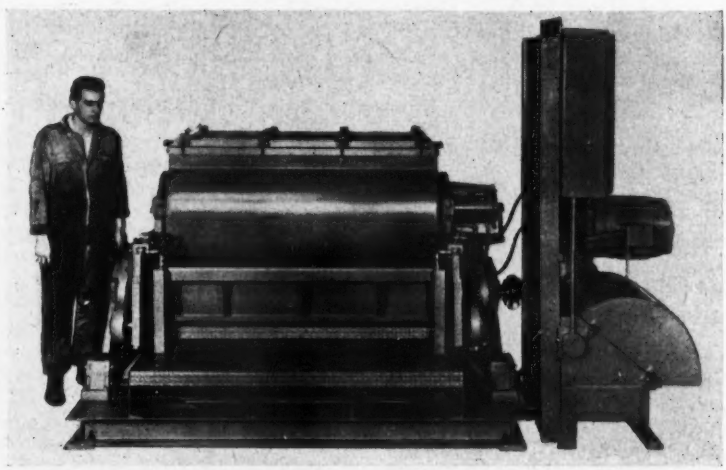
Selecto Vibro-Finisher De-burring and Burnishing Equipment

Davies Magnet Works, Ltd., Thundridge, Nr. Ware, Herts., are the sole manufacturers under licence for Europe, Africa and Australasia of the Selecto Vibro-Finisher de-burring and burnishing equipment developed by the Productive Equipment Corporation, Chicago, Ill., U.S.A. A typical installation is shown in the accompanying illustration. Standard types of chips, abrasives, and detergents, as developed for conventional barrel finishing, are employed in the Vibro-Finisher, the work-container of which is a plastics-lined, horizontal cylinder.

This container is mounted on a 4-bearing eccentric vibrator which maintains the contents in a constant state of vibration, and also causes them to travel in a circular path round the lining. The vibrator mechanism can be adjusted to provide eight different strokes from zero to ⅜-in., and the speed of the eccentric shafts, which are mounted in roller bearings with oil-bath lubrication, can be varied between 1,000 and 2,000 r.p.m.

Thirteen sizes of Vibro-Finishers are made, ranging in capacity from 1 cu. ft. to 18 cu. ft., and with driving motors from ¾ to 10 h.p. The smallest barrel size is 14 in. diameter by 10½ in. long, and the largest, 27 in. diameter by 54 in. long. Larger or special sizes can be supplied on request. The barrel and eccentric drive assembly is carried on anti-vibration mountings which reduce wear in the mechanism.

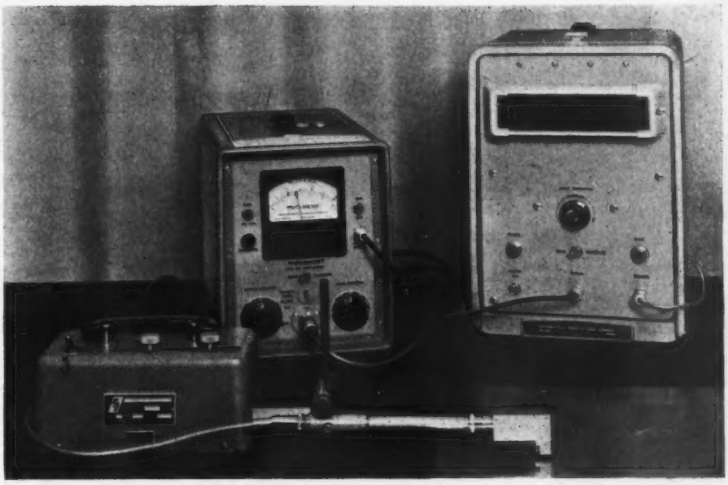
One of the advantages claimed for the process is that there is no impact, but merely a rubbing action, with the result that nicking, scratching, and distortion of the work are avoided, and operations ranging from the removal of burrs to the production of a very high lustre can be carried



Examples of the Selecto Vibro-Finisher equipment which is now being made by Davies Magnet Works, Ltd.

out. In addition, the barrel can be loaded to approximately 90 per cent of its capacity, and the cycle times are short. Components can be placed directly in the barrel or loaded on to fixtures, and when the latter are employed, provision is made for reversing the direction of rotation of the chips, if desired.

Provision is made for easily tilting the barrel for discharge and draining, and separating screens, which utilize the motion of the vibrator, and can be readily attached and removed, are available. Special fixture frames can be supplied to suit requirements, also barrels incorporating multiple-sections.



Micrometrical Profilometer surface measuring equipment with electronic peak counter

Micrometrical Profilometer with Electronic Peak Counter

The Micrometrical Mfg. Co., Ann Arbor, Michigan, U.S.A., have introduced the Profilometer surface measuring equipment here illustrated, which incorporates a peak counter and enables average-roughness-height readings and the number of surface irregularities above a pre-set level to be easily and accurately determined. It is claimed to offer particular advantages, for example, for controlling the surface quality of steel sheet to ensure satisfactory appearance after plating, or suitable bonding for paint.

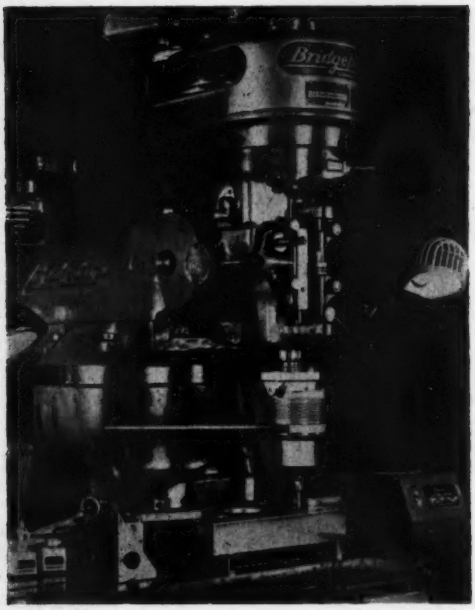
This equipment can also be set to record the average-roughness-height only. It comprises a type V-S Mototrace piloting unit modified to provide a gate trigger of 1-in. for the counter, and a type BK Linkarm connector on which is mounted a type MA Profilometer tracer fitted with a type AM Skidmount contact foot. Readings of average roughness height are obtained from a type QC-S Amplimeter, which has been modified to provide a level control, adjustable by the operator, whereby the peaks to be counted can be pre-set, according to height in micro-inches. The Amplimeter is connected to a type PE electronic high-speed frequency counter which provides a visual 3-digit display of the number of peaks, and incorporates an operator-controlled standardizing circuit.

The sole agents in this country for Micrometrical Profilometer equipment are Gaston E. Marbaix, Ltd., Devonshire House, Vicarage Crescent, Battersea, London, S.W.11.

"Precise" Electric Jig Grinding Attachment

An electric jig grinding attachment has been introduced recently by Precise Products Corp., Racine, Wis., U.S.A., for whom the sole agents in the United Kingdom are Matbro Machine Tools, Ltd., Matbro House, Beddington Lane, Croydon, Surrey. This attachment is the subject of a number of patents, and provides for grinding holes from 0·04 to 3¾ in. diameter. It is claimed that tolerances within 0·0001 in. can be maintained, with surface finishes of less than 10 micro-inches.

By means of a separate control unit, steplessly-variable speeds from 15,000 to 45,000 r.p.m. can be obtained for the spindle, the nose of which is arranged to take collets with capacities up to ¼ in., and the drive system provides a maximum power output of ½ h.p. On the type JA attachment, radial movement, for in-feeding, can be imparted while an operation is in progress, and is applied in increments of 0·00025 in. by means of a push-button. The total travel is indicated on a graduated dial, and for taking finishing cuts, feed is applied manually by means of a micrometer, which can be read to 0·0001 in. With the type JM grinder, in-feed is applied by the manual system only. The JA and JM units have overall



A "Precise" electric jig grinding attachment is here seen in use on a Bridgeport milling machine

lengths of 8 5/16 and 7 3/16 in., respectively, and weigh 10 and 8½ lb. No provision for radial movement is made on the type J attachment, which measures 5¾ in. long and weighs 7½ lb.

Each grinder is supplied in a fitted steel case, together with a wheel dresser, and an adjustable holder for a dial indicator, which is intended to facilitate centring the unit with the hole to be ground. In the figure, one of the units is seen in use on a Bridgeport milling machine.

ALLEN BORE VIEWER FOR SMALL HOLES. To facilitate the inspection of the side walls of small holes, bore viewers of two sizes have been introduced by P. W. Allen & Co., 253 Liverpool Road, London, N.1. Each comprises a battery handle on which is mounted a lens of 4× or 2× magnification, a light probe, and a sleeve with a small elliptical mirror. The type 316 viewer is suitable for holes from 1/8 to 3/16 in., and the type 380, for holes from 7/16 to 1¼ in. diameter and both are available with probes of three lengths which cover depths up to 8 in.

For viewing the bottoms of blind holes and valve seatings, for example, the light probe may be used without the mirror sleeve.

Mobile Gantry with Haltrac Hoist

The problem of moving comparatively heavy auxiliary equipment at the works of Payne Products International, Ltd., Buckingham Avenue, Trading Estate, Slough, Bucks., has been considerably facilitated by the mobile gantry here shown.

Need for such a unit arose because owing to the lack of overhead gantries or steel cross beams in the factory, parts such as lapping plates weighing up to 500 lb. had to be man-handled.

A gantry was very conveniently constructed from Dexion slotted angle, and at the centre of the bridge is attached a midget hoist made by Haltrac, Ltd., Bourne Works, Weimar Street, Putney, London, S.W.15. This hoist is made from high strength aluminium alloy, with high tensile steel bolts, and weighs only 1½ lb. It incorporates a pulley system which provides a velocity ratio of 8 to 1, and is provided with 72 ft. of braided nylon hoisting cord. On test, the unit has been found to have a breaking strength of more than 1,000 lb., on a straight lift, and the recommended safe capacity is of the order of 500 lb. The hoist is provided with an automatic locking attachment whereby the load can be sustained at any position, and inched in increments as small as ⅜ in.

A mobile gantry with a Haltrac midget hoist at the works of Payne Products International, Ltd., Slough

Machining Operations on Guide Rails for Passenger Lifts

A Set-up on a Boehringer Double-column Planing Machine

A TYPE 6Z/1250 DOUBLE-COLUMN PLANER built by Gebr. Boehringer G.m.b.H., Göppingen, Germany—a member company of the VDF group which is represented in this country by Sykes Machine Tool Co., Ltd., The Hythe, Staines, Middlesex—is shown in Fig. 1, fitted with a special tool slide and set up for machining, six at a time, 16-ft. 5-in. long mild steel guide rails of inverted T-section, for passenger lifts. Guide rails of various cross-sectional sizes can be handled on this machine, and an example is shown in the line drawing Fig. 2.

The machine in the figure has a capacity for planing workpieces up to 19 ft. 8 in. long by 4 ft. 1 in. wide by 2 ft. 9½ in. high, and the cutting and return speeds for the table can be varied steplessly and independently, in the range from 17·4 to 262 ft. per min., the current supply being

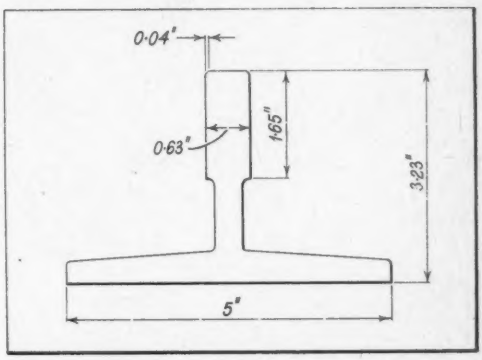


Fig. 2. Sectional view of a guide rail from the range handled on the Boehringer planer which is shown in Fig. 1

Fig. 1. A Boehringer type 6Z/1250 double-column planer is here shown set up for machining, six at a time, guide rails for passenger lifts

provided by a Ward-Leonard set. The special tool slide incorporates six solenoid-operated clapper boxes which will take separate interchangeable tool holders, and can be adjusted independently in the vertical direction by micrometer screws. A close-up view of the tool slide with the cover removed is given in Fig. 3. It can be traversed on the cross-rail by hand or power feed, and may be employed for taking a light cut on the top surface of the electro-magnetic work-holding fixture, if required.

Each holder is fitted with a total of seven cutting tools, four of which are employed for taking rough- and finish-planing cuts simultaneously on the side faces of one of the guide rails, a fifth for planing the top edge, and the remainder for machining the 0·04 in. by 45 deg. chamfers. High-speed steel cutting tools are usually employed, and the work-table is traversed at speeds of 92 ft. per min. for the cutting stroke and 246 ft. per min. for the return travel. Down feed is applied to the cross-rail on the column ways at the rate of 0·02 in. per table stroke for machining the side faces on the guide rails, and 0·004 in. per stroke for taking cuts on the top edges. The cycle time for machining six guide rails is 33 min. Down

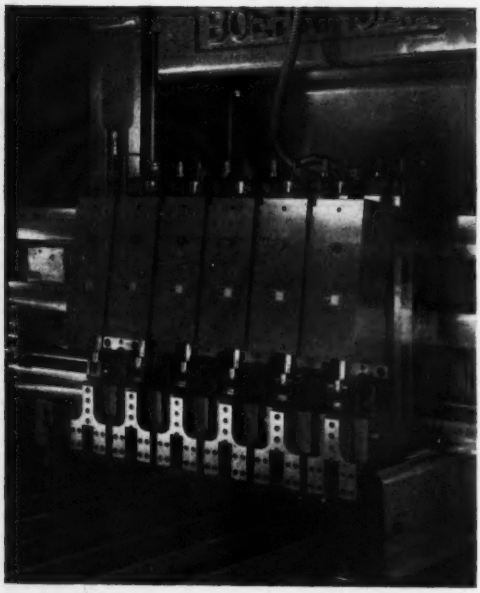


Fig. 3. Close-up view of the tool slide, with holders for multiple cutting tools, which is mounted on the cross rail of the Boehringer planer

feed is automatically interrupted by a limit switch built into the cross-rail, when the latter has been brought close to the end of its travel. At the same time, a signal lamp is lit. For taking a finishing cut on the top edges and chamfers, the cross-rail is lowered by hand until it makes contact with an adjustable stop secured to the guideways on the right-hand column, and in this way, the overall height of the guide rails is closely controlled. During the planing operation, from 0·031 to 0·047 in. of metal is usually removed from each side face, and about 0·060 in. from the top edge, and the 0·63 in. thickness and the overall height of each guide rail are held to limits of ±0·002 in. A copious supply of coolant is delivered to the individual sets of tools, which serves also to flush the cuttings clear of the working area.

ELECTRO-MAGNETIC WORK-HOLDING FIXTURES

Two work-holding fixtures are employed, one of which may be seen at *A* in Fig. 4, mounted on the table, and the other at *B*, resting on trestles on the shop floor at the side of the planing machine. With this arrangement, loading, setting up, and unloading of guide rails can be carried out while other rails are being machined. Each fixture has eight electro-magnetic chucks with top surfaces of 7⅞ by 39$\frac{7}{16}$ in., which are equally-spaced and are bolted transversely to the base, the outer chucks being so positioned that the guide rails are fully supported at their ends.

Before machining is carried out, the guide rails are accurately straightened, and it is important that there should be no distortion when the chucks are energized. To this end, two or four pairs of floating pole pieces of opposite polarity are provided at the various work-holding positions on each chuck, which automatically compensate for any small errors in straightness. The chuck is so designed that the magnetic field extends for only a short distance above the pole pieces, and during the planing operation, there is virtually no

Fig. 4. Two work-holding fixtures are provided, which enable loading, setting up, and unloading of guide rails to be carried out while other rails are being machined

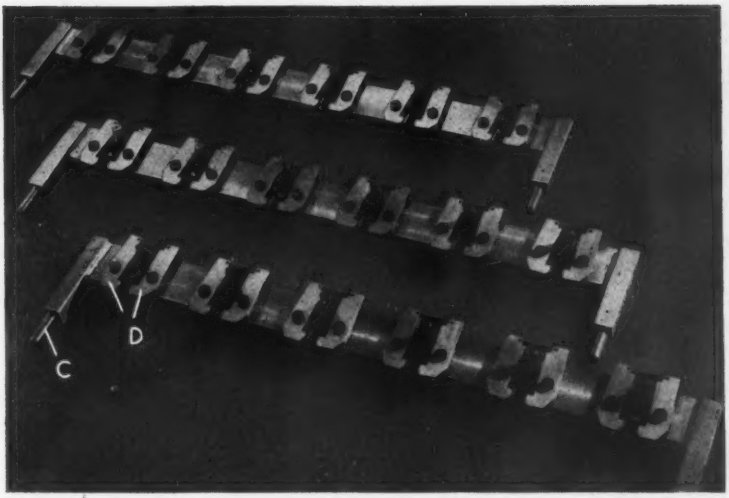


Fig. 5. A set of guide rails is positioned on a work-holding fixture with the aid of the three setting gauges here shown

magnetic flux at the portions of the work being machined, so that cuttings do not adhere to the surfaces. Cuttings fall between the rails, and are discharged down inclined surfaces on the fixture.

Guide rails to be machined are positioned on the fixture with the aid of three setting gauges, all of similar design, as shown in Fig. 5. These gauges have locating pins at their ends, as indicated at *C*, which enter holes bored in brackets secured to the edges of the fixture base close to the ends and at the centre. Each gauge has six pairs of spring-loaded jaws, as at *D*, which are brought into contact with the vertical side faces to be machined on the guide rails. Since three gauges are employed, the guide rails are set parallel with each other and with the edges of the fixture, and the jaws ensure that the pitch distance between the rails corresponds to that of the cutting tools on the planing machine (usually 6·69 in.).

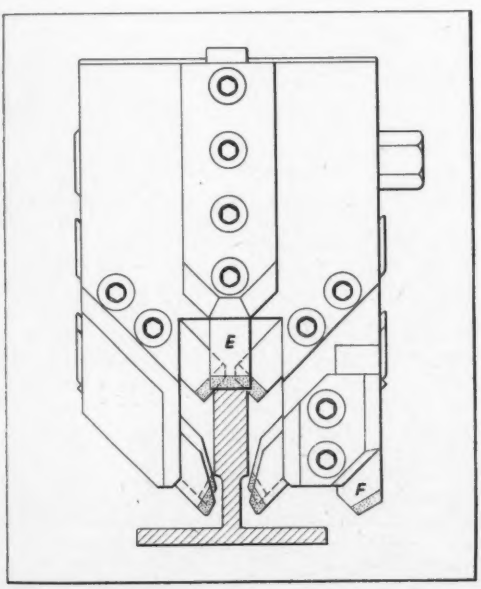


Fig. 6. With an alternative design of holder to those shown in Fig. 3, cutting tools for machining the side faces and chamfers on guide rails are mounted at an angle. Cuts can be taken on the top edge of the rail either by the tool *E*, with vertical feed, or the tool *F*, with horizontal feed

TRANSPOSING THE CHUCK

The chuck on which a set of guide rails is being set up is connected electrically to a rectifier set on the planing machine by a flexible cable. When setting up is in progress, the magnetic chucks may be partly energized by pressing a push-button, and the guide rails are then lightly held, but can be readily moved for final positioning, if required. At the completion of the setting up operation, the magnetic field for the chucks is increased by pressing another push-button, so that the guide rails are held more firmly. The entire chuck is now lifted on to the work-table of the machine. At the same time, a limit switch is closed, with the result that the chucks are fully energized for securely holding the guide rails for

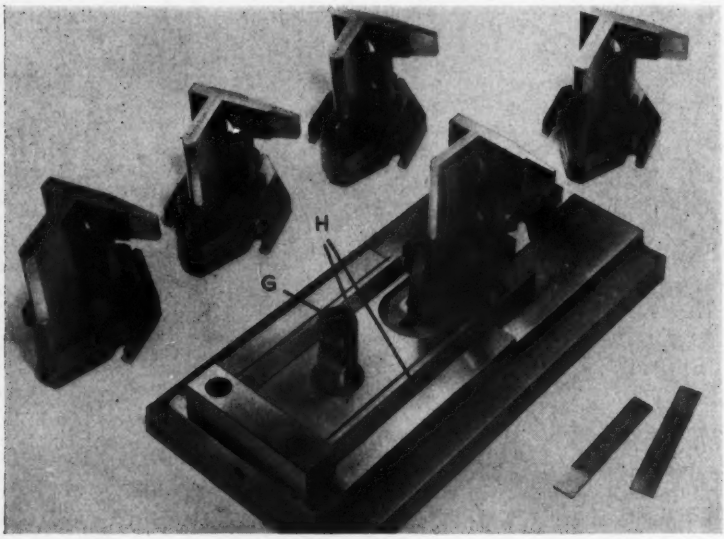


Fig. 7. A fixture and interchangeable attachments for pre-setting cutting tools in the holders

planing. A second cable is then connected to the fixture by means of a plug and socket, for energizing the chucks when planing is in progress, and the first cable may be disconnected. Current from the rectifier set is then supplied to the chucks by way of conductor bars at the rear of the bed, through sliding contacts on the table, and the second cable.

A 36-volt d.c. supply is provided, and the power consumption for each chuck is about 240 watts. There is a mechanical interlocking arrangement which prevents the second cable from being disconnected from the fixture, after the first cable has been removed. Another (electrical) interlocking system is provided, which prevents the traversing motion for the table from being started until the second cable has been connected to the fixture. In the event of failure of the mains supply to the planing machine, the supply from the rectifiers is automatically switched off, and current for the chucks is then derived from the generator in the Ward-Leonard set. While the latter continues to run idly before it is brought to rest, sufficient power is generated to ensure that the chucks remain energized until the table has been stopped.

The fixture is located on the table by two positioning bolts, disposed diagonally, and is then secured by other bolts. When planing has been completed on a set of guide rails, the first cable is again connected to the fixture, and the second cable is removed. In consequence, the chucks remain energized for holding the workpieces while the fixture is removed from the table. After the fixture has been brought clear, the chucks are de-energized for releasing the work by pressing another push-button.

TOOL SETTING FIXTURES

Cutting tools for machining the side faces and chamfers on guide rails are mounted horizontally in the holders shown in Fig. 3, and the tool for planing the top edge is set vertically. With an alternative design, the tools for machining the side faces and chamfers may be set at an angle in the holder as shown in the line drawing, Fig. 6, and this arrangement has the advantage that there is less restriction on the lengths of the shanks. Planing of the top edge may be carried out by the tool indicated at *E*, with the plunge-feed method as already mentioned, or by the vertically-mounted tool *F*, with feed applied horizontally to the tool slide on the cross-rail.

Each tool holder has two V-shaped bearing surfaces at the rear which engage with mating guideways on the clapper box, to ensure accurate location. There is a pin which projects from the front face of the clapper box and enters a bore in the rear face of the tool holder for positioning the latter in the vertical direction, and the assembly is secured by an eccentric clamping arrangement.

Cutting tools are pre-set in the holders with the aid of the fixture shown in Fig. 7, and slip gauges. On the base of the fixture there is a pin, as indicated at *G*, also guideways of inverted vee shape as at *H*, which serve for locating the holder while tool setting is being carried out, and are similar to those provided on the clapper box. Interchangeable attachments, as shown, can be mounted on the base for pre-setting cutting tools for machining guide rails of different cross-sectional shapes.

Large Vertical Dynapak Machine

The large vertical Dynapak 1810 machine shown in Fig. 1, which has been built by the General Dynamics Corporation, is installed in the Research Centre of American Brake Shoe Co., Mahwah, N.J., U.S.A., where it is being employed for experimental work and pilot production runs. Ram speeds from 250 to 1,500 in. per sec. are obtainable on this machine, and the operations carried out include forging, extruding, compacting, and blanking. In addition to carbon, high-speed, and stainless steels, copper, and aluminium alloys, various metals which have hitherto proved difficult to form are being worked experimentally, including commercially pure tungsten, molybdenum, titanium, columbium, and zirconium.

Dies employed on the machine are normally circular, and may range up to 22·5 in. diameter. An example of the work performed is illustrated in Fig. 2. In the foreground is a nozzle for a steel-works oxygen lance, which has been formed at one blow from a 9·1-lb. billet of alloyed, sintered copper, of the proportions seen at the right. The punch and die for the operation are also shown.

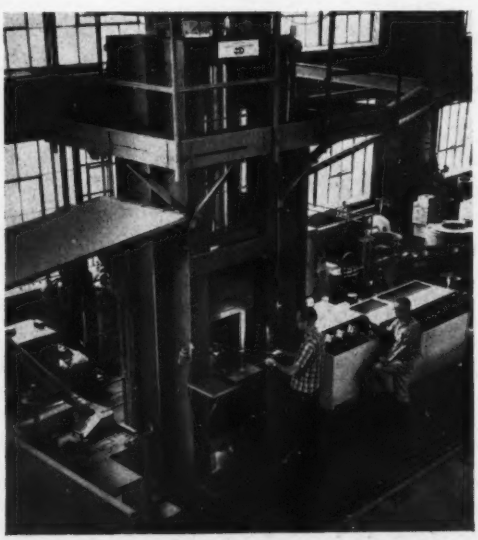


Fig. 1. This vertical Dynapak 1810 machine is being employed for pilot production runs

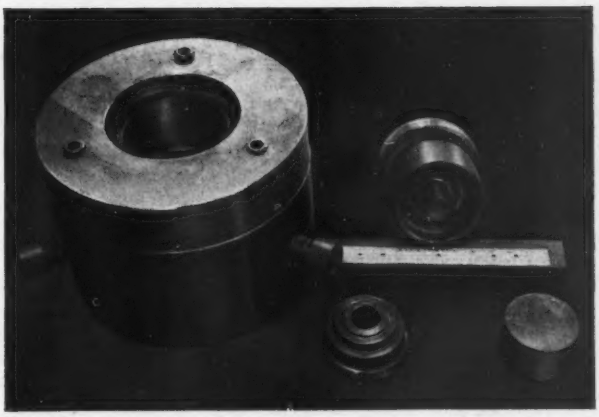
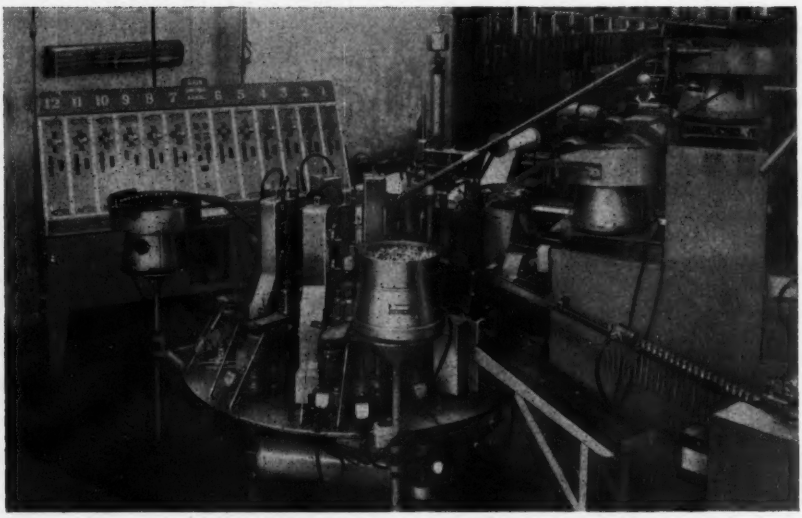


Fig. 2. The nozzle for a steel-works oxygen lance which is seen in the foreground was formed at one blow from an alloyed copper billet of the proportions seen at the right

The cycle time of the Dynapak machine is 105 sec. and at the end of the stroke the ram is returned hydraulically. During this stage, nitrogen, which is employed to impart the high velocity, is re-compressed in a high pressure chamber.

LOW TEMPERATURE STRETCH-FORMING PROCESS. Arde-Portland, Inc., Paramus, N.J., U.S.A., have developed a process known as Ardeform for the production of stainless steel vessels and tubes of high strength and ductility. This process has been introduced to exploit the discovery, which was made some time ago, that cold-working at very low temperatures results in a substantial improvement in the room-temperature strength of austenitic stainless steels. With the Ardeform technique, an undersize vessel is produced from annealed sheet stock by rolling and welding.

The preform is placed in a stainless steel forming die in a tank below ground level, to which liquid nitrogen is then admitted. Subsequently, the preform is also filled with liquid nitrogen, and when the material reaches the required temperature (−320 deg. F.) nitrogen gas is admitted to the interior by way of a pressurizing line. The preform is thus expanded to fill the die cavity. It is stated that with this method vessels with nominal tensile strengths up to 285,000 lb. per sq. in. have been produced.



Automatic Assembly of Shock Absorber Piston Rods

Details of a New Automatic Assembly Machine Designed and Built by Vauxhall Motors, Ltd., Luton

By R. E. GREEN, Associate Editor

THE FIRST TRULY AUTOMATIC assembly machine to be put into operation by Vauxhall Motors, Ltd., Luton, Beds., was designed and built by their production engineering division and has been in full operation since October, 1959. The machine produces assemblies at the rate of 600 per hour, and in the two years of its life has so far completed well over 2,000,000 units. Any of nine slightly different versions of piston and rod components can be assembled as required, by small adjustments to the machine. A general view of the equipment is given in the heading illustration, where the main control panel, which is connected to the machine by plug-in cables and sockets, is seen at the left.

The machine is designed to assemble, in the correct sequence, a total of 11 components to the piston rod of the Vauxhall double-acting, telescopic, shock absorber, and finally to screw on and tighten a nut at one end. Some details of typical machining operations on Vauxhall shock absorber components, it may be noted, were given in MACHINERY, 84/263—5/2/54, at which time assembly methods were largely manual. Components which are assembled to the piston rod are shown in Fig. 1, and comprise, from the left, back-up and spacing washers; a star-shaped spider spring for the valve plate; the compression inlet valve plate; the piston; the orifice plate; a spring disc; the rebound valve back plate; a spring seat; a relief valve spring; and a piston nut, as mentioned above.

All these parts require to be assembled to the reduced-diameter threaded end of the piston rod, as seen at the bottom left in Fig. 1, and a completed assembly is shown at the top. Inspection of components, on a percentage basis only, is carried out before they are fed to the machine, and measuring units are therefore incorporated in the latter whereby dimensional and contour checks can

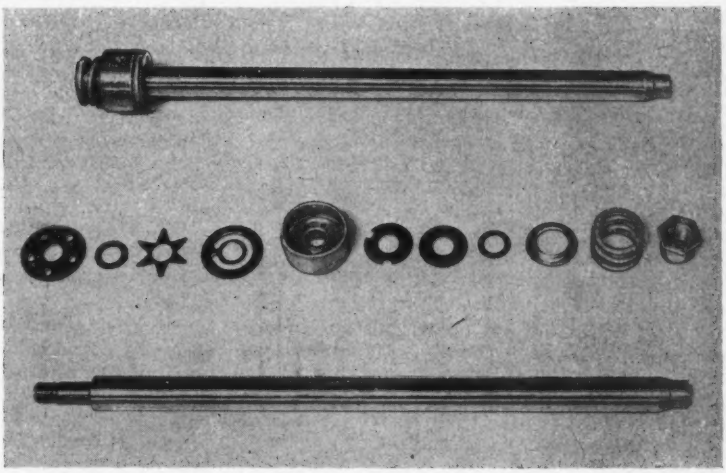


Fig. 1. One of the piston rods employed in shock absorbers fitted to Vauxhall cars, and the components which are loaded on to the threaded end. Valves are incorporated which control the movement of the oil from one side of the piston to the other during the "bump" and "rebound" movements of the suspension

be made. When faulty components are detected, the machine is stopped automatically, and the location of the fault is indicated, so that it can be quickly rectified.

Another general view of the machine is given in Fig. 2, from the opposite side to that in the heading illustration, and shows the 6-ft. diameter base plate on which the various automatic assembly mechanisms are mounted. Beneath this plate, which is of mild steel and is supported on substantial tubular legs, there is an air-operated indexing mechanism, which is of ingenious design and provides for a total of 30 movements per revolution of the table. A drawing showing the arrangement of the indexing mechanism is seen in Fig. 3, which shows the cast-iron table, supported on a vertical spindle. Fixed to the underside of the table there are 15 roller races, which are held on stub shafts located at intervals of 24 deg. on a common pitch circle.

These roller races provide both for indexing the table through 12 deg., and for locking it in position after indexing is completed. The spaces between the rollers are engaged by cams *A*, which are of similar shape, and are carried at opposite ends of an air-operated slide *B*, that moves in guide-ways on the supporting structure beneath the table. Control of the air supply to the cylinder is by means of a solenoid valve, and as the slide moves in one direction, the less acute side of one of the cams is brought into contact with one of

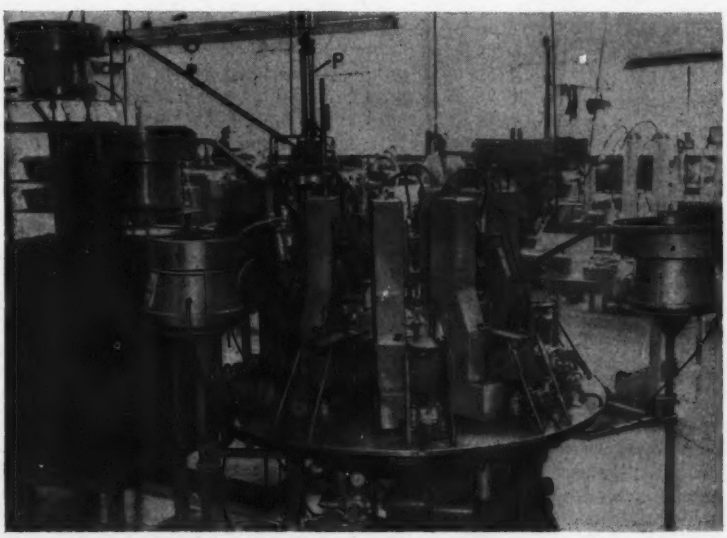


Fig. 2. General view of the automatic assembly machine developed by the Vauxhall production engineering division for the assembly of parts to the piston rod shown in Fig. 1. This view is taken from the side opposite to that shown in the heading illustration

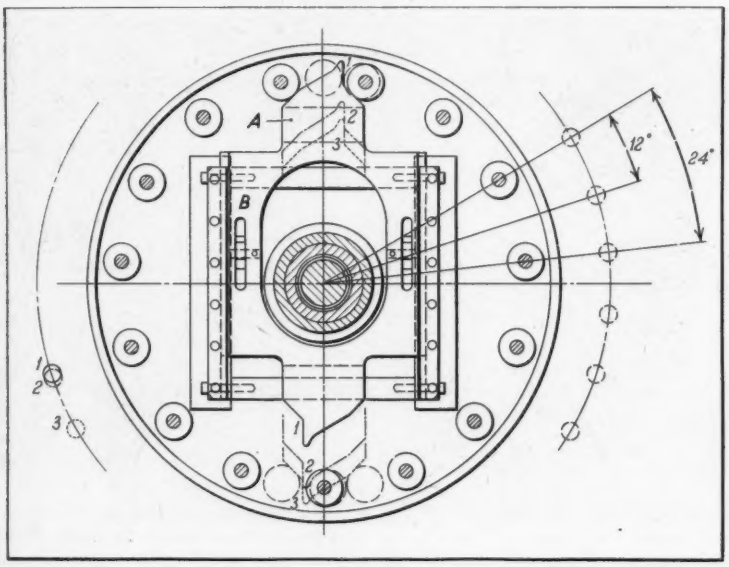


Fig. 3. The table of the automatic assembly machine is indexed by an air-operated slide which has cams at each end. These cams act against 15 rollers which are spaced at intervals of 24 deg. on the underside of the table, and serve to rotate and to lock it in position

the rollers, thereby turning the table in an anti-clockwise direction. Further movement of the slide, in the same direction, brings the other side of the cam into engagement with the next roller.

Finally, other portions of the cam, which are disposed at angles of 45 deg., and are equally spaced at each side of the centre line of the slide, are brought into contact with both rollers, to lock the table securely in the new position. The sequence of movements, and positions of the cams and the rollers, are shown by the dotted outlines in Fig. 3, and the speed of travel of the slide is controlled by valves, which provide a fast initial movement followed by a slow, final, engagement in order to eliminate "rebound." Each movement of the indexing slide turns the table through half the angular distance between the rollers, that is 12 deg., giving the required number of divisions.

The table has a flange at the top in which there are 30 equally-spaced holes. These holes incorporate flanged bushes which serve to support the piston rods vertically, when they are loaded. Beneath the flange, the table periphery has a screw thread on which there is an internally-threaded ring of duralumin, carrying 30 equally-spaced spring-loaded plungers. The plungers determine the height at which the piston rods are supported in the flanged bushes, and the ring can be adjusted by screwing it up or down to suit the five different lengths of piston rods which are handled on the machine.

Surrounding the table, on the baseplate, are 12 special electro-pneumatic assembly heads, each designed to load a particular component. Six of these heads employ vacuum-operated pick-up mechanisms, connected by way of a "ring main" beneath the table to a vacuum pump and tank underneath the baseplate, as can be seen in the heading illustration and Fig. 1. There is a seventh head of this type which is provided as a spare. Each vacuum-type head is arranged to pick up components from a carrier rod which has been previously loaded with the required items. Sockets are provided near the edge of the baseplate for the insertion of spare carrier rods, holding further supplies of parts, so that an empty rod can be quickly replaced by a full one.

Loading of the rods is performed automatically by means of Podmore vibratory hoppers on which provision is made for uniform orientation of the components to suit the arrangement of the pick-up fingers and the assembly sequence. Because of difficulties associated with picking up thin parts, such as the washers and valve plates seen in Fig. 1, which vary in thickness, from 0·004 to 0·008 in., and in diameter from $\frac{7}{16}$ to $\frac{3}{4}$ in., all the parts employed in shock absorbers are cleaned in trichlorethylene, the bath being ultrasonically agitated to speed up and improve its action. An additional advantage of this method of cleaning is that it ensures a high degree of cleanliness in the finished assemblies, and thus contributes to a trouble-free working life.

Other heads on the machine are of the mechanical-feed type, and incorporate chutes down which the parts slide under gravity, from Podmore vibratory feed hoppers. Guides, traps and

gates in the chutes ensure that each part is correctly orientated when it reaches the assembly position. A spare head of this type is also provided, so that it may be quickly substituted for a faulty unit, and the latter is then removed to the toolroom for servicing, before being returned to take its place as a spare. The plug-in connections between the main control panel and the individual heads enable them to be changed very easily.

All the heads are fitted with limit switches that are actuated at the ends of the feed motions, and others that are closed on the return of the heads to the start positions. When all the "head returned" limit switches have been actuated, the solenoid valve controlling the indexing air cylinder is operated, and the table is turned to the next position, another limit switch then being closed by the indexing slide to start the next series of feed motions of the heads. As the heads move forward, "feed" and "return" indicator lamps are illuminated and extinguished on the main control panel, and these lamps are extinguished and illuminated in the reverse order on the return of each head to the start position. Should a head fail to feed properly, or subsequently to return, the lamps remain illuminated to indicate the position of the fault to the operator who tends the machine.

ASSEMBLY OPERATIONS

At the first head on the machine, seen at the extreme left in Fig. 2, and close-up in Fig. 4, piston rods are fed to the flanged bushes on the table from the hopper at the left, in which the rods are loaded with the threaded ends to the left. This hopper has two roller chains that pass through slots in the bottom face, on which the lower layer of the rods rests. When the chains are moved forward by an air-operated ratchet indexing mechanism, through a distance equal to their pitch, the foremost rod is carried through an opening in the front wall of the hopper. This opening is of just sufficient height to allow the rod to pass when it is resting in the recesses of the roller chain side plates, and the rod is deposited on the grooved upper face of a pivoted arm *C*.

This arm is secured to the end of a shaft in a housing at the right-hand side of the hopper, and the other end of the shaft carries a disc *D*, from which projects an eccentric pin. The ram of the air cylinder *E* is connected to this pin, so that operation of the cylinder rotates the disc and turns the shaft, moving the arm *C* from the horizontal to the vertical position, as shown. In this position, the lower end of the arm is directly above one of the flanged bushes in the table, and the piston rod is supported by a stop.

This stop is of the retractable type and is moved aside automatically as the arm reaches the end of its travel, and the rod is then free to slide down and to enter the flanged bush.

A back-up washer, at the extreme left in Fig. 1, is the next item required, and washers are fed from a vibratory hopper, with their flanges uppermost, to the head just visible at the right in Fig. 4. These washers pass down a chute into a selector chamber, from which they are fed by an air cylinder to an opening directly above the piston rod. Another air cylinder advances a sleeve, from above, to push the washer down against the shoulder on the rod. If the hole in the washer is too small to pass over the end of the piston rod, the latter is pushed down, against the pressure of the spring-loaded plunger in the duralumin ring mentioned previously, and a limit switch is operated to stop the machine cycle.

With the exception of head No. 6, which handles pistons, the following six heads are all of similar design, and are employed to assemble the thin shim-stock components on the piston rod. A close-up view showing details of the third head is given in Fig. 5, where it may be seen that there are two discs, mounted on the ends of two parallel

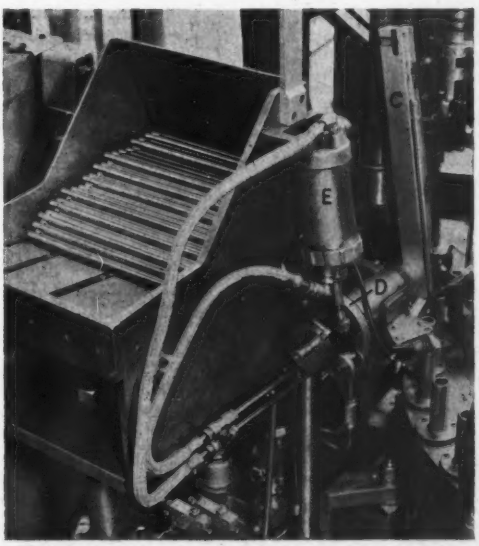


Fig. 4. Close-up view of the first station on the automatic assembly machine, showing details of the hopper from which the piston rods are fed by means of a roller chain mechanism. Also seen is the arm *C*, whereby the rods are raised to the vertical position for loading

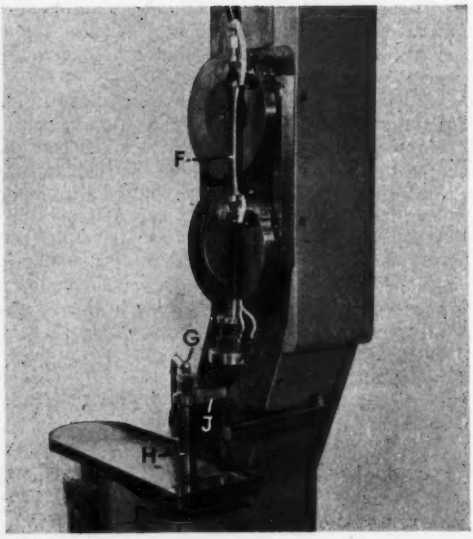


Fig. 5. Side view of one of the vacuum pick-up units whereby the thin shim-stock components are lifted from pre-loaded carrier rods. The vacuum head is carried on the end of the tube *F*, which is moved through an arc of 110 deg. in a vertical plane

shafts in the upper portion of the head. Each disc has an eccentric free-running pin, with a transverse hole, and the latter serve to accommodate a vertical tube *F*, the upper end of which is connected to the vacuum manifold. Both the shafts are turned simultaneously by means of an air-operated rack and pinion mechanism within the head, and the lower end of the tube is thereby oscillated through an arc of 110 deg., from a position directly above the stack of components on the taper-ended loading bar *G*, to a position directly above the end of the piston rod in the table.

At the bottom of the tube *F* there is a pick-up head, the lower face of which is designed to match the contours of the particular shim-stock component to be handled. The face of the head is made in two pieces which are electrically insulated and are connected in a circuit which must be completed at the start of the cycle, if the head is to operate correctly. The pick-up head is lowered over the bar *G*, at the end of the cycle, and if the topmost component in the stack is not sufficiently high to complete the circuit through the head segments, another circuit is made to a small electric motor at the rear of the head.

This motor is seen more clearly in Fig. 6, which is a view of the head from the rear, with the covers removed, and it is arranged to drive a nut on a threaded, hollow shaft *H*, Fig. 5. A carrier bar, loaded with components, is placed in the bore of this shaft, where it is supported at a pre-set height, but the shaft can be adjusted vertically by means of the motor. At the top of the shaft there is a non-rotating arm *J*, the slotted end of which is engaged with a vertical key, projecting from the side of the head, and when the loaded carrier rod is placed in position, the components are supported on the top face of this arm.

If the pick-up head fails to make contact with the topmost component, the motor is switched on and the stack of parts resting on the arm is fed slowly upwards. When the topmost part makes contact with the two segments of the head a circuit is completed, and simultaneously the current supply to the motor is interrupted. The stack then remains at the new level until a similar sequence of events occurs. At the start of the cycle, the head is connected to the suction mains so that the topmost part in the stack is picked up. Picking up is facilitated by an air jet from a horizontal nozzle *K*, Fig. 6, which is positioned level

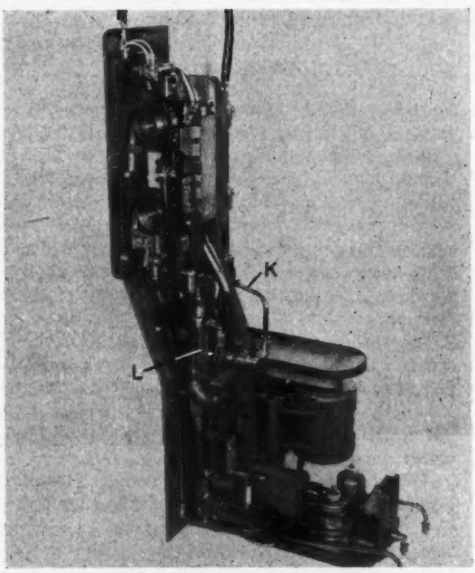


Fig. 6. View of the unit seen in Fig. 5 from the opposite side, with the covers removed to show details of the operating mechanism for the pick-up head. Rotation of the two shafts carrying the discs for the vacuum tube is effected by a rack and pinion mechanism, actuated by the air cylinder *L*

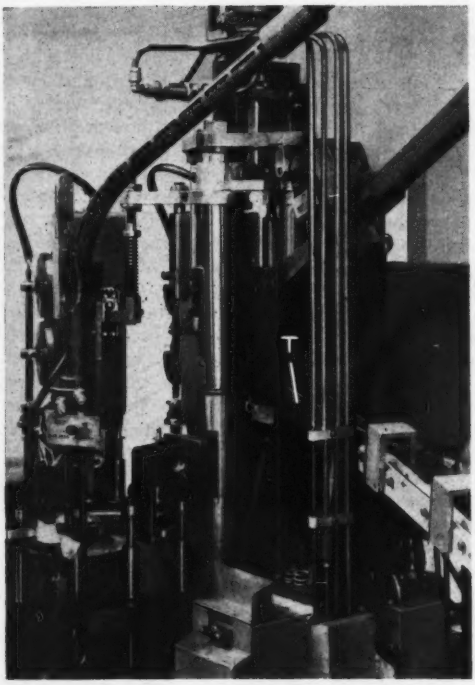


Fig. 7. Close-up view of the final station of the assembly machine, whereby the nut is applied and screwed on to the thread. The completed assembly is automatically lifted from the table and discharged down the chute *T*

with the top of the stack and is turned on momentarily as the suction head is raised.

The air blast serves to separate the topmost part from the next in the stack, to ensure that a single component only is picked up. This part is then carried over and lowered on to the end of the piston rod, and the suction connection is interrupted to release it. At the same time, the tube *F*, Fig. 5, is momentarily connected to a source of compressed air, which blows the part from the pick-up head and urges it over the end of the piston rod. Other details which can be seen in Fig. 6 include the vertical air cylinder *L* for actuating the feed tube. The ram of this cylinder is connected to the end of the rack above, the teeth of which mesh with pinions on the two shafts carrying the discs mentioned earlier.

The uppermost of the two shafts also carries a cam which operates micro-switches connected to solenoid valves for the control of the connections between the pick-up head and the suction and compressed air lines, at appropriate periods of the cycle. A cam on the lower shaft actuates other switches and solenoid valves controlling the compressed air supply to the cylinder *L*, through adjustable restrictor valves which govern the speed of movement of the suction head, providing slow withdrawal and approach speeds, combined with an intermediate fast motion.

The sixth head is of the mechanically-operated type, and is employed to feed the piston, which is supplied with the hollow side upwards from a vibratory hopper at the nearer side of the machine in Fig. 2. Pistons are fed into a selector chamber, as before, and are pushed through an opening and over the end of the piston rod beneath. After this operation, suction-type heads are employed to load the orifice plate, spring disc and rebound-valve back plate, and the piston rod then reaches station 10, where the spring seat is placed in position by means of a head similar to those for assembling the back-up washer and piston. The seat has a large central hole, which provides a generous clearance on the piston rod, and it can therefore be allowed to fall over the rod end under gravity.

The relief valve spring is loaded at the eleventh position, seen in the foreground in the heading illustration, the springs being fed down an inclined chute under gravity from the vibratory hopper at the upper right-hand side. At the lower end of the chute is a simple, air-operated escapement mechanism which allows the springs to pass through, one at a time, and they fall over the piston rod end, resting on the previously-loaded spring seat. The lower end of the chute is seen at the left in Fig. 7, which also shows the final station, at which the retaining nut is screwed on to the end of the rod.

Nuts of the type seen at the right in Fig. 1 are fed to the twelfth station from a vibratory hopper which is at a slightly lower level than that provided for the tenth position, and are delivered with the hexagon ends uppermost by the hopper selector guides. These nuts pass down an inclined chute and are arrested by an escapement mechanism actuated by the movement of an air cylinder-operated slide at the top of the head. From this point, the nuts progress singly, and each nut slides down into a slot in a carriage, in which it is suspended in a vertical position.

Another view of the head, from the centre of the table (with station 11 just visible at the right, and station 1 at the left) is given in Fig. 8, and the carriage mentioned above is suspended from the cross-head *N*, which is fitted with bushes and is guided on vertical cylindrical pillars at each

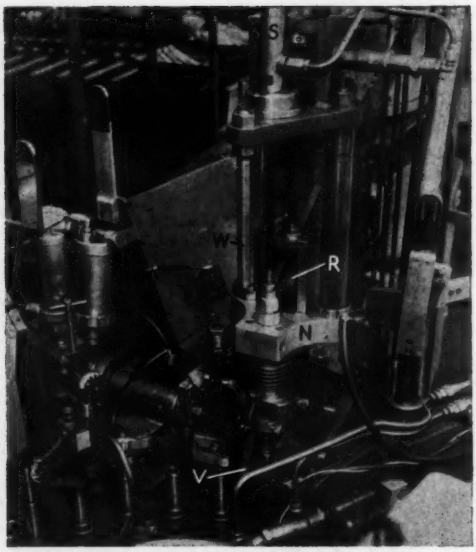


Fig. 8. Further details of the final station of the assembly machine are visible in this view, which also shows station 1 at the left- and station 11 at the right-hand side

side. The ram of the vertically-mounted air cylinder, *P*, Fig. 2, which is carried on a cross-piece at the top of the head, is connected to the carriage by means of a stirrup, that clears the end of the chute *R*, Fig. 8. An extension at the front of the cross-head accommodates a Desoutter air-operated nut runner, the body of which can move vertically and is spring-loaded downwards.

The spindle of this nut runner is fitted with a driver having four equally-spaced chisel-blades, which engage the top face of the nut in the carriage beneath, and when the air cylinder above is actuated, the cross-head is brought down, lowering the nut into engagement with the end of the piston rod. Further downward movement of the cross-head then applies two rubber-faced clamps, which are suspended from the carriage and grip the shaft portion of the piston rod and prevent it from rotating. The driver is subsequently moved into engagement with the nut, and turns it through several revolutions, to ensure that the complete assembly cannot leave the shaft before the nut is finally tightened at a later stage.

The air supply to the nut runner is turned on and off automatically by a valve *S*, on the cross-piece supporting the main air cylinder, and this valve is linked to the cross-head by a long shaft. As the driver of the nut runner approaches the nut, the air is turned on, and as the cross-head is retracted, it is cut off, automatically. During the retraction of the cross-head, the clamps mentioned earlier raise the completed assembly from the flanged bush in the table, and lift it to a position at which the piston is slightly higher than the end of a second chute, which leads downwards, out of the machine.

This chute is seen at *T*, Fig. 7, and when the assembly has been raised to the required position, it is ejected from the clamps by a lever *V*, Fig. 8, pivoted in a slot in the carriage, and falls into the chute. The lever *V* is pushed towards the assembly, against the pressure of a spring which urges it outwards, by a fixed stop on the end of a stud *W*, fixed to the cross-piece at the top of the head. Completed assemblies pass down the chute to a separate machine, which is designed to tighten the nuts to a pre-set torque value, and are then passed to the main assembly line.

The assembly machine, which is now installed in a new, enclosed shop at the Dunstable plant of Vauxhall Motors, Ltd., cost some £8,000 to build, and has enabled the time required for the assembly operations to be reduced from 0·706 to 0·27 min. This reduction, taken over the year, has resulted in an annual saving of about £9,300. Another machine, designed for the assembly of different shock absorber components, is now being developed and will provide for a pressing operation in addition to automatic settings for the nine different types of shock absorber now being produced. It is hoped to make further reference to this machine when it is completed.

LARGE STEAM TURBINE GENERATOR. The Allis-Chalmers Mfg. Co., U.S.A., have recently received an order from the Consolidated Edison Co., New York, for a steam turbine generator of more than one million kW. capacity which is scheduled for operation in 1966. This large generating set will be of cross compound design with one high pressure, one intermediate pressure, and three low pressure sections. The high and intermediate pressure sections will be coupled in tandem to drive one of the two fully-supercharged hydrogen-cooled generators at 3,600 r.p.m., and the three low pressure sections will be coupled in tandem to drive the other generator at 1,800 r.p.m. Steam will be supplied to the high-pressure section at 2,400 lb. per sq. in. and a temperature of 1,000 deg. F. After passing through the high pressure section, the steam will return to the boiler for reheating to 1,000 deg. F. before entering the intermediate section, and continuing through the three low pressure sections.

E.M.I.-S.I.P. Rotoptic Rotary Table

A Rotoptic type 6 CN, 31½-in. diameter rotary table made by Société Genevoise d' Instruments de Physique, Geneva, Switzerland, and arranged for automatic indexing under the control of punched tape equipment developed by E.M.I. Electronics, Ltd., Hayes, Middlesex, was demonstrated recently at the works of the latter company. The table is shown set up on a S.I.P. jig borer in the illustration, and the floor-mounted console which forms part of the E.M.I. control system may be seen at the right.

Details of the Rotoptic tape-controlled table were given in MACHINERY, 96/1637—29/6/60, and it will be recalled that there are two measuring systems, one of which comprises, basically, a resolver that translates the angular position of the table into an analogue a.c. voltage. This system is employed in conjunction with a squirrel-cage driving motor to bring the platen to within 30 min. of arc of the desired position. A separate servo-motor is then automatically brought into use, and final positioning of the table, to an accuracy of ±2 sec. of arc, is controlled by an E.M.I. 12-in. diameter inductosyn. Provision is made for simultaneous adjustment of both measuring systems through angles up to 5 deg. on either side of the central position to facilitate setting to zero. The squirrel-cage motor is brought into use for angular adjustments greater than 5 deg., and may be employed for rotating the platen continuously, for example, when the work is to be checked for concentricity with the aid of a dial indicator.

The table can be operated from the numerical control system which has been developed for S.I.P. jig boring machines, and is designed to take 1-in. wide, 8-channel, punched paper tape. Alternatively, it can be employed as a separate unit, and provision can then be made for setting from information provided on standard $\frac{11}{16}$-in. wide, 5-channel tape, if required. In addition to the tape control system, dials are provided on the control console for presetting individual angular positions for the platen, and the direction of rotation can be selected by means of a switch. The positioning cycle, under the control of tape or dials, is initiated by a push-button on the side of the table, and the drive for continuously rotating the platen is started and stopped by a switch. When the positioning cycle has been completed, the platen is secured by a lever-operated pinch-type clamp which is applied to a ring, and is so designed that the setting is not disturbed. An optical measuring system is normally provided for setting the platen by hand, which gives readings to 1 sec. of arc.

The platen is supported near the periphery on bearing balls, and the central spindle runs in plain bearings. It is designed to take workpieces which weigh up to 2,200 lb., but in certain circumstances it will support loads weighing up to a maximum of 3,300 lb. The E.M.I. inductosyn is housed in an additional base which carries the main table assembly, and the overall height of the unit is 14½ in., and the weight, 1,700 lb.

Sales of Rotoptic tape-controlled rotary tables are handled in this country by E.M.I. Electronics, Ltd., and Société Genevoise, Ltd., Newport Pagnell, Bucks.

The Rotoptic type 6 CN rotary table which incorporates E.M.I. tape control equipment is here shown mounted on an S.I.P. jig borer

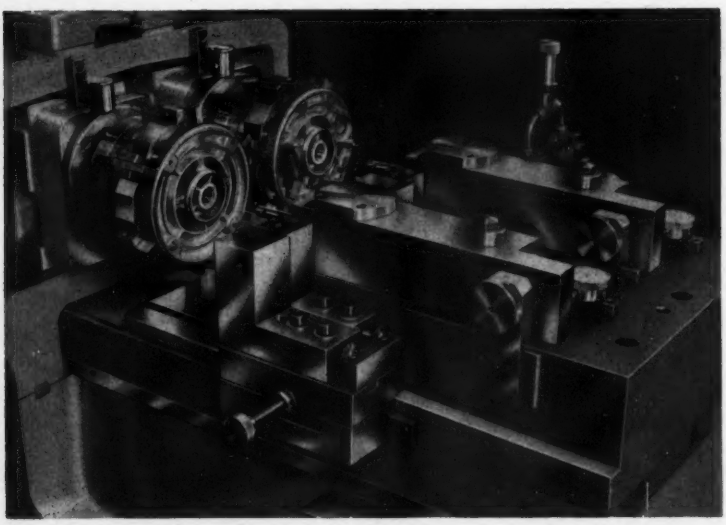
NEWS OF THE INDUSTRY

Nottingham and District

BONEHAM & TURNER, LTD., Nottingham Road, Mansfield, are occupied with the manufacture of their wide variety of products. The company offers a comprehensive range of sizes and types of jig bushes, and has recently added a metric series, ranging from 0·90 mm. to 10·50 mm. bore size. Other items include anchor bushes for drilling jigs, ground dowel pins, grinding and fine-boring spindles, fine boring heads and complete machines, memory drums for electronic computers, and a range of die-sets. Special work is also undertaken from time to time, usually of a type associated with one of the standard products.

During a recent visit special mention was made of the popularity of the company's jig-grinding attachments, and we were informed that the capacity of these units has been increased to 4½ in. diameter. Many orders for such attachments are in hand, a large proportion being destined for overseas markets, including France, Canada, Australia, India and Pakistan. Export orders have also recently been executed for other products, including several fine-boring machines for Italy, and 25 high-frequency, 100,000-r.p.m., spindle units for the U.S.S.R., which were in progress at the time of our last visit. Among equipment recently completed for the home market, our attention was drawn to 4-spindle boring heads which were supplied for use on a transfer machine for operations on motor vehicle pistons. These heads were required for a station at which the gudgeon pin holes are fine bored in four pistons at a time.

Typical of work recently undertaken by the company is a fine-boring machine supplied to a large manufacturer of fractional horse-power electric motors. A close-up view of this machine is seen in the accompanying figure, with two motor end-plates in position for facing and boring, which is performed automatically. Since the operations are completed at one setting, concentricity is ensured, and the centre-hole is held to limits of 0·0002 in. The end-plates, of 5·666 in. diameter, are handled at the rate of 150 per hour.



Close-up view of a 2-spindle fine-boring machine built by Boneham & Turner, Ltd., for operations on end-plates for f.h.p. motors

Recent additions to the manufacturing equipment include a Parkson 2N universal milling machine, and three Dean, Smith & Grace lathes, of 16-in. swing by 40-in. capacity between centres, are due for early delivery.

E. W. BLISS (ENGLAND), LTD., City Road, Derby, report that the recent re-organization of certain plant and equipment within their factory has now been completed and is making a full contribution to their heavy production requirements. The floor space at the Haslams Lane Factory has been doubled, and this factory provides for the assembly of large

mechanical and hydraulic presses. A good demand for all types of presses is reported, and particularly for inclinable C-frame types with capacities of 10 tons and over. We may also note that a steady flow of export orders is being received for high production presses of between 45 and 250 tons.

Among machines recently completed for the home market, attention may be drawn to a 250-ton hydraulic press, which was designed in conjunction with P.E.R.A. for use by that organization for investigations in connection with the extrusion of steel. An order has since been received from a Government Department for a similar press. Our attention was also drawn to several large hydraulic presses with capacities up to 1,500 tons.

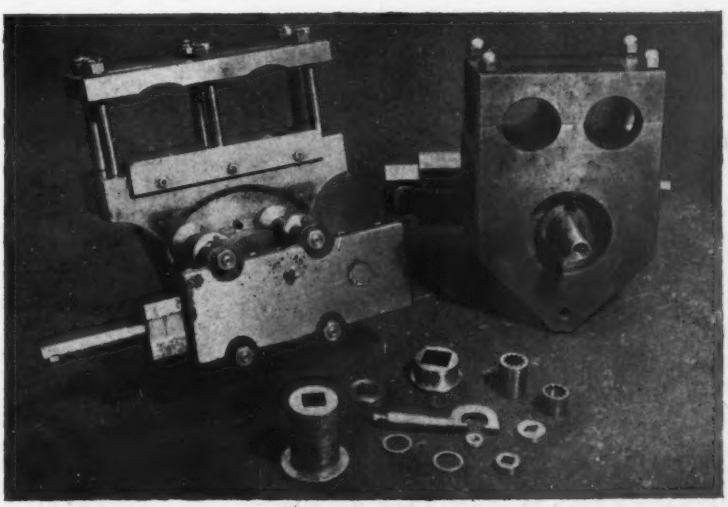
Export orders form a large part of the company's business, and a 500-ton transfer press destined for Australia has lately been completed. Bliss engineers are at present setting up machinery in Italy and Portugal, and the latter installation includes a 24-die Bliss 37A bottle-cap press which operates at speeds up to 130 strokes per min. The equipment also includes sheet feed and waxing attachments by other makers. The same customer has also ordered Bliss equipment for producing pilfer-proof bottle caps, which is due for delivery in the near future.

MYFORD, LTD., Beeston, Nottingham, are busy with the production of the ML 7 and Super Seven 3½-in. centre lathes and accessories, orders for which are maintained at a high level. The Mini-Kop series 1A hydraulic copying lathe, which was introduced at the Engineering and Marine Exhibition in April of this year, has been very well received in both the home and overseas markets. At the same exhibition, the company showed the MG12-H 5-in. by 12-in. hydraulic cylindrical grinder. This machine is now in production, and supplies will be available for the home market in the early part of next year. A satisfactory demand is reported for the ML 8 multi-purpose woodworker, and the 5-in. PR 11 planer.

The recently added production floor area is now in use, and additional drawing office space is about to be occupied. We noted that recent additions to the plant have included a C.V.A. 415 TF vertical milling machine with 94-in. table and 50-in. longitudinal traverse; two Ward 2A and two Ward 3A capstan lathes; and a B.S.A. form generating machine which is being used for rolling leadscrews.

CASTLE ENGINEERING CO. (NOTTINGHAM), LTD., Haslam Street, Castle Boulevard, Nottingham, who undertake precision contract machining, report that they are being called upon to produce an increasing variety of components. Items which we noted during a recent visit included parts for the steering-gear for a small family car, parts for shoe makers' lasts, and an assortment of components for earth-moving equipment, domestic washing machines, ciné-projectors, and vehicle braking systems. We were interested to learn that this company undertook some of the pilot prototype production in connection with the Borg-Warner 1½-litre automatic transmission.

In common with other companies engaged on precision repetition machining, this firm has found it expedient not only to make jigs and fixtures for the work which is undertaken, but frequently to adapt machines. The illustration shows the way in which the use of comparatively expensive machines and equipment was avoided in connection with the production of parts with irregularly shaped bores. Standard broaches could not be employed, and special tools would have cost too much in view of



These simple slotting attachments were made by Castle Engineering Co. (Nottingham), Ltd., to permit economical machining of irregularly shaped apertures

the type of work and quantities involved. The two slotting attachments illustrated were designed and made for use with standard milling machines, and because of their simplicity the cost was considerably lower than that of proprietary attachments.

The company has a well-equipped automatic shop, which is in the process of being reorganized slightly, and we may note that a certain amount of multi-spindle auto capacity, within the range 1⅛ to 2⅝-in., was available at the time of our visit.

FRECONOMY CO., LTD., Eastfield Side, Sutton-in-Ashfield, now have some 80 skilled tool room employees engaged in the production of press tools, plastics moulds, die casting dies, and powder-metallurgy tooling, and extremely complicated work is undertaken. We noted that orders were on hand at the time of our visit for a number of very prominent companies. During the past six months, the toolmaking capacity has been increased by about 50 per cent, and much new plant has been installed or ordered. Two more Société Genevoise jig-borers have been added, making five in all, and other recent additions include six Dean, Smith & Grace lathes of various sizes; four Jones & Shipman 540 P surface grinders; four Jones & Shipman 1310-ERU universal grinders; eight Bridgeport turret milling machines; and four Deckel GKU 21 pantograph milling machines.

RAGLAN ENGINEERING CO. (1954), LTD., Raleigh Street, Nottingham, are busy with the production of their Raglan 5-in. centre lathe, and have a full order book, a good proportion of the machines being destined for export. Our attention was drawn to the fact that the Central Office of Information selected a Raglan lathe for display at the International Indian Industries Fair which was held in New Delhi last month, and showed enlarged photographs of Indian students using these lathes in a training centre. The display was staged on the British Government Stand and was concerned with co-operation with the Indian Government in connection with the training of technologists.

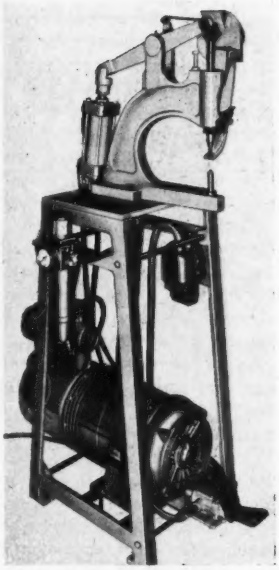
It is claimed that the Raglan lathe was the first British machine tool to be externally styled by a design consultant, and that this course has been well justified by its popularity.

The most recent addition to the company's products was the Raglan test piece lathe.

J. J. MARKLEW.

London and the South

HUNTON, LTD., 114-116 Euston Road, N.W.1, report an increasing demand for their hand- and treadle-operated Phœnix range of eyeletting machines arranged for bench or stand mounting. Most of the machines may be converted to pneumatic operation to permit rapid production, and the Autophœnix No. 6, which is here illustrated, may be provided with an electrically-driven Hymatic Hydrovane air compressor mounted within the frame adjacent to the control pedal. An air compressor of this type, it may be noted, has sufficient output to supply several eyeletting machines installed in the same shop if necessary, when air from a main distribution line is not available. We understand that Phœnix eyeletting machines are employed by a number of firms for fixing parts to chassis for electrical and electronic equipment, and for similar purposes.



The Autophoenix No. 6 pneumatically-operated eyeletting machine incorporates a Hymatic Hydrovane compressor

Hunton universal bolster outfits and associated tooling are still in good request, and are widely employed for short runs on simple press work and for various notching and punching applications. Punches and dies for piercing holes and blanking discs from ⅛ in. to 3¾ in. diameter, in steps of 1/32 in., are usually available from stock, and other sizes can be supplied at short notice. There is also a steady call for Whitney portable punching, bending, and shearing machines for plate, bars, and sections.

HALL HARDING, LTD., Stourton House, Dacre Street, S.W.1, report an increasing demand for their Cavendish range of drawing office equipment, which has been designed to afford improved standards of comfort for draughtsmen and designers, as suggested as a result of recent research into drawing office conditions. The Cavendish free-standing drawing table incorporates sensitive spring-tensioned counterbalancing arrangements, and can be set at a height to suit the recommended low seating position of 16½ in. above floor level.

Better utilization of drawing office space, it is stated, may be obtained by the use of the com-

pany's range of unit construction tables, which enable the layout to be varied to suit particular conditions, and allow plan storage space to be adjusted as required by the substitution of one unit for another The company has acquired the agency for the Micromat film recording and enlarging unit. Photographic film of 70 or 35 mm. width is employed and may be used for making records from translucent or opaque originals. We understand that the Unax SM high speed diazocopier unit will shortly become available. It has a maximum output of 30 prints per min. in sizes up to 15 by 10 in.

EFCO FURNACES, LTD., Queen's Road, Weybridge, Surrey, are well occupied with orders for heat treatment furnaces for a variety of applications, and recently supplied a salt bath installation for hardening and tempering cutters, to Gleason Works, Ltd., Watford. The four Efco-Upton salt baths for this installation together have a loading of 270 kW., and are fitted with submerged electrodes built into the furnace walls. As only one face is exposed, electrode life is thus extended. Efco-Park heat treatment salts K3, Nu-Sal, Hi-Heat and L.T.D. 1, are used in these salt baths.

At the new factory of Rootes, Ltd., at Linwood, near Paisley, Scotland, where the small Hillman car is to be built, there will be a comprehensive installation of Efco heat treatment plant, including closed-quench furnaces, tempering and reheating furnaces, endothermic atmosphere generators and charge handling equipment, all of which will be electrically operated.

WEYBURN ENGINEERING CO., LTD., Elstead, Surrey, are providing improved facilities for the production of a wide variety of precision parts under sub contract. For this purpose an additional shop is being built, which is to be equipped with new machine tools. Reorganization of the existing shops has now been completed, and some of the production methods have been modified to permit substantial increases in the outputs of camshafts and hydraulic equipment.

The company is principally occupied with the machining of parts for the motor vehicle and aircraft industries, but work is also undertaken for manufacturers of textile, refrigerating, and agricultural equipment, for example.

Founded in 1913, this firm has expanded steadily, and it is interesting to note that of the 750 people employed in all departments, including a smaller factory at Eashing, Surrey, more than half have served for periods exceeding 10 years.

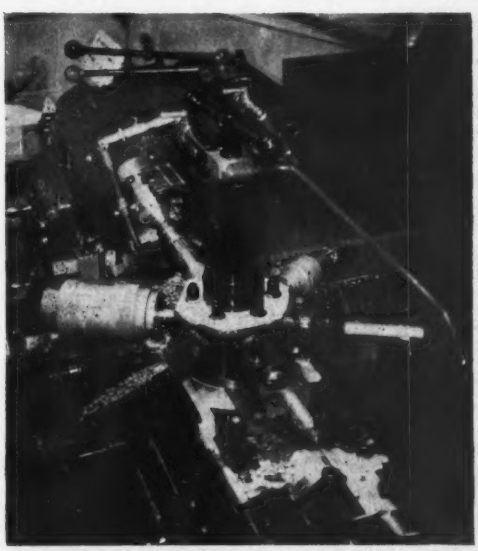
NORTH WEST MACHINE DESIGN CO., LTD., 177 Kenton Road, Harrow, Middlesex, inform us that increasing demands are being made on their drawing and design departments which are being progressively expanded. Various aspects of production engineering are covered by one part of the organization, and the design of special purpose equipment; rotary and in-line transfer machines; milling, grinding and boring machines; and jigs, fixtures and press tools, has been undertaken since the company was founded.

A stretch forming machine, designed by this firm, is employed for the production of airframe members and other parts for aircraft where the work material is required to be curved in two directions. Mention may also be made of another machine built by the company for applying Stellite heat-resisting alloy to the seating surfaces of exhaust valves for motor vehicles. With this machine the output of treated valves was increased five-fold as compared with that previously obtained.

F. W. HERRIDGE.

B.T.G. Demonstration

An interesting demonstration of a typical application of B.T.G.-Madison tooling was given recently at the Engineering Centre, Stephenson Place, Birmingham, when Birmingham Tool & Gauge Co., Ltd., and other members of the Denbro Group held a display of their products. The B.T.G.-Madison



Set-up on a Ward 3 DS capstan lathe for drilling, boring, reaming and roller burnishing internal and external surfaces

tooling was set up on a Ward type 3 DS capstan lathe, as shown in the figure, to produce a part with internal and external roller-burnished surfaces within a tolerance of 0·001 in. and with a finish of approximately 5 micro-inches. The 6-station turret tooling comprised a spade drill, as made by B.T.G. for Alfred Herbert, Ltd.; a Madison rough boring tool; a Madison reaming tool; a Madison automatic recessing tool; and Madison internal and external burnishing Microllers.

The component was turned from En. 24 steel (low nickel chrome) and to produce a suitable finish on the 2·375-in. outside diameter, from the cross-slide, a tungsten carbide tipped tool from the Betaloy range was employed. The cutting edge was ground so as to produce a "peak and valley" pattern on the work at a spindle speed of 635 r.p.m. and a feed of 0·008 in. per rev., and thus provide a satisfactory surface for external burnishing at the final operation.

The first turret operation provided for drilling a $1\frac{17}{32}$-in. diameter hole with a spade tool at a speed of 260 r.p.m. and a feed rate of 0·005 in. per rev. Coolant was fed to the cutting edge through the body of the drill, and the swarf was produced in the form of small chips. Approximately 0·1 in. of metal (a side) was removed from the bore at the second operation stage. A standard 1·735-in. diameter Madison boring bar, with a tungsten carbide tipped double-edged boring tool, was used at a speed of 540 r.p.m. and a feed rate of 0·008 in. per rev. The bore was semi-finished to 1·748 in. diameter, at the same speed and feed as for the preceding operation, by means of a reamer, with tungsten carbide cutting blades, which were pre-set with a micrometer to the correct diameter. The reamer was allowed to float by about 0·005 in.

At the fourth operation stage, a 0·250-in. wide by 0·125-in. deep groove was machined with an automatic recessing tool, previously set by means of two calibrated stop nuts, and the tool produced chamfers at either side of the cut. A Madison Microller internal burnishing tool was applied, at the fifth stage, to increase the diameter of the bore by 0·0015 in. in one pass, at a speed of 260 r.p.m. This tool, it may be mentioned, is designed so that the rollers feed forward off the taper mounting at the end of the forward motion, thus facilitating withdrawal from the burnished bore. Burnishing of the external surface was also carried out in one pass with a standard Madison external Microller, which is self-feeding and is arranged so that the burnishing rollers move clear of the work surface at the end of the pass. The component was machined in a floor-to-floor time of 7 min., and the burnishing operations left the bore and external surfaces in a work-hardened condition.

Industrial Notes

NORTHIDE, LTD., P.O. Box No. 5, Hyde, Cheshire, are marketing P.V.C. gloves which are claimed to offer effective protection against minor cuts when handling swarf, while affording freedom of manipulation.

AN AUCTION SALE OF MACHINE TOOLS and miscellaneous stores will be held at the Central Ordnance Depot, Didcot, Berks., on January 9. The auctioneers will be Simmons & Son (Dept. L). 12 Station Road, Reading.

JESSOP-SAVILLE, LTD., Sheffield, 1, have announced that there is to be a further reduction, amounting to about 10-15 per cent, in the price of most titanium products, at the end of the year. This reduction, which will be the sixth since 1955, has been made possible by increased output and improvements in production methods.

STANLEY WORKS (G.B.), LTD., Rutland Road, Sheffield, 3, have agreed, subject to Treasury consent, to purchase from John Brown & Co., Ltd., and from the minority shareholders, all the shares in S. N. Bridges & Co., Ltd. It is stated that the latter company will continue to manufacture and operate independently, and that the management has agreed to continue in office.

STANDARD SIZES FOR DRAWING SHEETS.—A new Standard (B.S.3429) covers sizes of drawing sheets. There are two sections, the first of which is concerned with engineering drawings, and the second with architects' and builders' drawings.

Copies of the Specification may be obtained from the British Standards Institution, Sales Branch, 2 Park Street, London, W.1. (Price 3s.—postage extra to non-subscribers.)

THE COLCHESTER LATHE CO., LTD., Hythe, Colchester, have announced that more than 60 per cent of their total production of centre lathes is now being exported, also that the markets in which their sales are expanding include North America, Germany, and Japan. The annual output of these lathes already exceeds 3,500, and it is stated that this figure will be substantially increased when extensions, which are now being built, have been completed.

THE INSTITUTION OF PLANT ENGINEERS, 2 Grosvenor Gardens, London, S.W.1, will sponsor a symposium on "Modern Rolling Mill Practice" which will be held in the Engineering Lecture Theatre, The University, St. George's Square (Mappin Street entrance), Sheffield, on April 11, 1962. There will be three papers concerned with: developments in the design of rolling mills; modern control techniques for rolling mills; and modern techniques for servicing rolling mills. Further particulars and registration forms can be obtained from the secretary at the above address.

THE SCOTTISH MECHANICAL ENGINEERS TRAINING ASSOCIATION has been formed by six leading engineering companies, including two machine tool firms, to make provision for co-operative training. The programme involves initial training to be undertaken wholly or partially during university or college vacations, followed by a 2-year post-graduate period, and is intended to lead to membership of the Institution of Mechanical Engineers. Training will be concerned, for example, with design and development, research, estimating, purchasing, costing, selling, administration, and management. The organizing secretary is Dr. J. C. Morrison, 126 Cleveden Road, Glasgow, W.2.

Machine Tool Exports and Imports

EXPORTS OF MACHINE TOOLS

Type of Machine	Month ended September 30, 1961	Nine months ended September 30	
		1960	1961
	Value £	Value £	Value £
New, complete:—			
Bar and chucking automatics	28,214	567,868	795,468
Boring machines:			
Vertical	35,081	285,285	693,355
Other	87,583	934,432	835,869
Drilling machines	132,483	942,257	1,088,573
Gear-cutting machines	111,108	788,719	875,073
Grinding, lapping and honing machines	237,838	1,954,332	2,621,512
Lathes:			
Capstan and turret	220,252	1,553,328	2,184,314
Other	332,224	2,687,556	3,189,642
Milling machines	197,703	1,548,225	2,561,977
Planing machines	—	148,379	226,547
Presses:			
Hydraulic	68,843	701,867	995,406
Other	115,054	1,881,881	1,027,539
Punching and shearing machines	27,276	431,645	538,490
Other plate and sheet-metal working machines, including straightening rolls	80,608	462,850	642,445
Screwing and threading machines	78,597	600,925	744,666
Shaping and slotting machines	28,495	304,583	347,484
All other machines	285,655	2,047,216	2,632,702
Used, complete	53,709	874,842	607,342
Parts	470,959	2,258,212	3,022,936
Total	2,591,982	20,974,402	25,631,340
Destination			
India	464,001	2,529,777	3,426,692
Australia	290,222	4,608,160	2,969,446
New Zealand	39,310	307,351	625,315
Canada	53,817	982,976	1,091,160
Other Commonwealth countries	150,169	1,138,249	1,430,844
South Africa	97,846	942,226	1,109,474
Soviet Union	23,398	291,905	573,615
Sweden	81,595	568,546	852,507
Western Germany	186,380	834,685	1,519,901
Netherlands	83,609	440,853	659,314
France	160,509	1,220,183	1,339,550
Spain	46,087	345,006	664,416
Italy	117,523	566,059	1,656,349
United States of America	56,960	1,826,680	887,446
Other foreign countries	740,556	4,371,746	6,825,311

IMPORTS OF MACHINE TOOLS

New, complete:—			
Bar and chucking automatics	91,898	418,169	799,972
Boring machines	218,056	984,335	1,308,502
Drilling machines	24,480	267,513	347,732
Gear-cutting machines	19,553	496,314	1,332,957
Grinding, lapping and honing machines	426,205	3,190,313	3,574,259
Lathes	226,704	1,562,521	2,655,100
Milling machines	328,575	2,317,479	2,644,611
Planing, shaping and slotting machines	21,561	272,917	402,977
Presses	163,022	1,139,318	1,458,321
All other machines	660,643	2,834,367	4,875,771
Used machines, complete	40,850	982,838	650,159
Parts	360,710	2,357,716	3,017,588
Total	2,582,257	16,824,800	23,067,949
Country of Origin			
Western Germany	1,005,621	4,816,769	6,926,319
Switzerland	262,603	2,272,134	2,446,367
U.S. America	897,753	6,934,194	8,956,399
Other countries	416,280	2,801,703	4,738,864

MACHINERY'S ENQUIRY BUREAU

For many years MACHINERY has provided an enquiry service not only for subscribers and advertisers but for all engineers in need of such information as the names of makers—or their agents—of machines or equipment for performing particular operations, suppliers of various classes of material, firms with facilities for undertaking certain types of work, owners of trade names, and agents for foreign machine builders. If you have such a problem write (MACHINERY, Enquiry Bureau, Clifton House, 83-117 Euston Road, London, N.W.1) or telephone (Euston 8441, 2 lines). This service is, of course, entirely free.

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20/12/61

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That it shall not, without the written consent of the publishers first given, be lent, resold, hired out or otherwise disposed of by way of trade except at the full retail price of 1s. 3d. and, that it shall not be lent, resold, hired out or otherwise disposed of in a mutilated condition or in an unauthorised cover by way of trade; or affixed to or as part of any publication or advertising literary or pictorial matter whatsoever.

Monks & Crane Newcastle Premises

Monks & Crane, Ltd. have had a branch in Newcastle for a number of years. Owing to the rapid growth of the company's business in this area over the past few years, however, larger premises became necessary. The new stockrooms and offices were officially opened on December 6, and to mark the occasion, a cocktail reception was held at the Royal Station Hotel, Newcastle, on the evening of that date. This function was very well attended by industrial buyers and representatives of many of the companies whose products are handled by Monks & Crane.

In proposing a toast to "Our Guests," Mr. V. G. Eyre, managing director, thanked those present for their support in the past, and promised a better service in the area now that increased stocks could be carried. Early in the evening, the guests were taken by car to inspect the new premises, and were shown the very comprehensive stocks of all lines handled by the company. In addition, a representative range of machine tools was on view. The address of the new branch is George Street, Newcastle, and the branch manager is Mr. T. R. Cook.

New Companies Registered*

KEELAVITE COMPONENTS, LTD., Keelavite Works, Birmingham Road, Allesley, Warwicks. Registered November 30, 1961. To carry on the business of engineers, etc. Nom. cap.: £75,000. Directors to be appointed by subscribers. Subscribers: G. V. Keeling and M. D. Bradbury.

JOHN THOMPSON ORDNANCE CO., LTD. Registered November 30, 1961. To acquire part of the business of John Thompson (Wolverhampton), Ltd., and to carry on the business of manufacturers of and dealers in ordnance, small arms, etc. Nom. cap.: £150,000. Directors: Sir Edward W. Thompson, C. R. Thompson, R. D. Edwards, A. N. Mills, F. P. Connor and J. H. N. Thompson.

GLASS TUBES AND COMPONENTS, LTD.—Registered November 23, 1961. To take over part of the undertakings of A.E.I., Lamp and Fitting Co., Ltd., and General Electric Co., Ltd. Nom. cap.: £2,500,000. Directors to be appointed by subscribers. Subscribers: D. M. Vickers, Magnet House, Kingsway, London, W.C.2, and G. C. Bodington, 33 Grosvenor Place, London, S.W.1.

* From the lists compiled by Jordan & Sons, Ltd., Company Registration Agents, 116-118 Chancery Lane, London, W.C.2.

New Appointments

The following new appointments have been announced:—

MR. ARNOLD CARR, deputy chairman and assistant managing director of Thos. W. Ward, Ltd., Albion Works, Sheffield, as joint managing director of the company.

MR. GEORGE ARGYLE, A.M.I.Mech.E., as chief engineer, (commercial vehicles) for The British Motor Corporation, Ltd., Longbridge, Birmingham, following the recent appointment of Mr. Alec Issigonis as technical director of B.M.C.

Obituary

MR. FRANK THOMPSON-SCHWAB, chairman of the Darwins Group of companies and of Balfour & Darwins, Ltd., died recently at the age of 70. He organized the expansion of the Darwins Group to embrace a number of important companies, and was responsible, with Lord Riverdale for the merger between Darwins and Arthur Balfour & Co., Ltd. A London stockbroker, he effectively mastered the complexities of the Group's activities, which are concerned with steel, castings, forgings, wire and sheet, hand tools, and various finished products. Mr. Thompson-Schwab was a Freeman of the City of London, and a Freeman of the Cutlers' Company.

Scrap Metals

†LONDON.—‡Prices per ton for non-ferrous scrap metals free from iron are as follows:—Clean copper wire, untinned and free from lead and solder, £193; clean heavy copper, untinned and free from lead and solder, £185; copper wire No. 2, £175; clean light copper, £175; braziery copper, £154; gunmetal, £165; brass, mixed, £122; lead, net, £47; zinc, £28; cast aluminium, £80; old rolled aluminium, £92; battery lead, £24; unsweated brass radiators, £98; hollow pewter, £570; black pewter, £450.

MIDLANDS.—There has been little change during the past two weeks but the position of copper appears to have consolidated, mainly on account of the Katanga situation and the possibility that production may be affected.

In general, the market for most metals, including tin, is slow and only moderate interest is being shown by buyers. With the approach of the holidays it is possible that a fair quantity of scrap will change hands, mainly from the small merchants and engineering works, even if prices for some grades are not very attractive.

The following notes give a general indication of market conditions for various metals:—

Copper—A small increase ranging up to £3 per ton, for bright wire, No. 1 wire and clean heavy scrap, emphasizes the firmness of higher grades.

Brass—A steady demand continues with little change in values. An extra £1 or £2 per ton may, however, be obtained if justified by the quantity offered.

Gunmetal—Consumers are still cautious, and prices show little improvement.

Lead—There has been a slight easing following the recent gains. Prospects do not appear to be better for the near future, as demand is not encouraging.

Aluminium—Trading conditions are still uninspiring. Consumers are keeping a close watch on stocks, and prices are therefore uninteresting. Markets are not readily available, but it appears that most of the scrap offered is taken up. Prices in excess of the accepted low values are obtained occasionally, provided that the material is of good quality.

Zinc—There has been no change in prices, but the tone may improve if the present steady demand continues.

† George Cohen, Sons & Co., Ltd., 600 Wood Lane, London, W.12.
‡ Subject to market fluctuations.

Machine Tool Share Market

Stock markets were mainly dull during the period under review, and although there was some improvement towards the finish, the general trend was for prices to drift to lower levels in nearly all sections.

The gilt-edged market was subdued, and for the most part British Government stocks and kindred issues tended to fall, but the tone hardened at the close.

Activity in the commercial and industrial sections remained at a low level with buying interest selective, and apart from a few firm features, changes on balance were irregular with declines predominating.

Among machine tool issues, Edgar Allen lost 1s. at 30s.; Arnott & Harrison, 6d. at 12s.; British Oxygen, 6d. at 14s. 6d.; Chas. Churchill, 3d. at 8s. 4½d.; Coventry Gauge & Tool, 1s. 9d. at 30s. 10½d.; Craven Bros. (Manchester), 3d. at 8s. 1½d.; Greenwood & Batley, 6d. at 15s. 6d.; John Harper, 1½d. at 7s. 9d.; Alfred Herbert, 1s. 6d. at 62s. 6d.; H. W. Kearns, 6d. at 19s. 9d.; Kerry's (Gt. Britain), 3d. at 7s. 9d.; Ambrose Shardlow, 1s. 3d. at 52s. 6d.; John Shaw & Sons (Wolverhampton), 6d. at 13s. 10½d.; Tap & Die Corporation, 1s. at 18s.; and Thos. W. Ward, 2s. 6d. at 62s. 6d. On the other hand, Birmingham Small Arms advanced 6d. to 19s.; and F. Pratt Engineering, 1s. to 15s. 6d.

BUTLER MACHINE TOOL CO., LTD. Dividend 15 per cent.

COVENTRY GAUGE & TOOL CO., LTD. Final ordinary dividend 7½d., tax free, per 10s. unit, making, with the interim, a total of 10½d. net, as compared with 9d.

F. PRATT ENGINEERING CORPORATION, LTD. Final dividend 14 per cent, making, with the interim, a total distribution of 20 per cent, as against 18 per cent.

Trade Publications

F. J. EDWARDS, LTD., 359-361 Euston Road, London, N.W.1. Folder giving concise descriptions of the Sealwel 1250 and 3000 welding machines for PVC and certain other materials. These machines, for which the company is sole agent, have 1½ kW. and 3 kW. generators respectively.

SCIAKY ELECTRIC WELDING MACHINES, LTD., Falmouth Road (Trading Estate), Slough, Bucks. Brochure SS.144, of 16 pages, is concerned with cross-wire welding techniques and equipment. Various machines are described, and general information is given on welding fixtures and automatic methods. Resistance welding data for such operations are tabulated.

COMPANY		Denom.	Middle Price
Abwood Machine Tools, Ltd.	Ord.	1/-	1/6
Allen (Edgar) & Co., Ltd.	Ord.	£1	30/-
" " "	5% Prf.	£1	12/9
Arnott & Harrison, Ltd.	Ord.	4/-	12/-xd
Asquith Machine Tool Corp., Ltd.	Ord.	5/-	10/-
" " "	6% Cum. Prf.	£1	16/6
Birmingham Small Arms Co., Ltd.	Ord.	10/-	19/-
" " "	5% Cum. "A" Prf.	£1	13/-
" " "	6% Cum. "B" Prf.	£1	16/6
" "	4% 1st Mort. Deb.	Stk.	90½xd
British Oxygen Co., Ltd.	Ord.	5/-	14/6
" " "	6% Cum. Prf.	£1	18/6
Brooke Tool Manufacturing Co., Ltd.	Ord.	5/-	7/7½
Broom & Wade, Ltd.	Ord.	5/-	22/-
" " "	6% Cum. Prf.	£1	16/-
Brown (David) Corporation, Ltd.	5½% Cum. Prf.	£1	14/-
Buck & Hickman, Ltd.	6% Cum. Prf.	£1	17/-
Butler Machine Tool Co., Ltd.	Ord.	5/-	15/-
" " "	5% Cum. Prf.	£1	12/6
Churchill (Charles) & Co., Ltd.	Ord.	2/-	8/4½
" " "	6% Cum. Prf.	£1	25/7½‡
Clarkson (Engrs.), Ltd.	Ord.	1/-	7/3
Cohen (George), 600 Group, Ltd.	Ord.	5/-	9/6
" " "	4½% Cum. Prf.	£1	12/-
Coventry Gauge & Tool Co., Ltd.	Ord.	10/-	30/10½
" " "	5% Cum. Red. Prf.	£1	16/3
Craven Bros. (Manchester), Ltd.	Ord.	5/-	8/1½
Elliott (B.) & Co., Ltd.	Ord.	1/-	2/9
" "	4½% Red. Cum. Prf.	£1	11/3xd
Firth Brown Tools, Ltd.	4% Cum. Prf.	£1	10/6
Greenwood & Batley, Ltd.	Ord.	10/-	15/6
Harper (John) & Co., Ltd.	Ord.	5/-	7/9
" " "	4½% Red. Cum. Pref.	£1	9/6
Herbert (Alfred), Ltd.	Ord.	£1	62/6
Holroyd (John) & Co., Ltd.	"A" Ord.	5/-	20/-xd
" "	"B" Ord.	5/-	17/9xd
Jones (A. A.) & Shipman, Ltd.	Ord.	5/-	25/-
" " "	7% Cum. Prf.	5/-	4/6xd
Kearney & Trecker-C.V.A., Ltd.	5½% Red. Cum. Prf.	£1	8/9
" " "	Prefd. Ord.	£1	13/9
Kearns (H. W.) & Co., Ltd.	Ord.	5/-	19/9xd
Kerry's (Gt. Britain), Ltd.	Ord.	5/-	7/9
Macreadys Metal Co., Ltd.	Ord.	5/-	15/-
Martin Bros. (Machinery), Ltd.	Ord.	2/-	2/6
Massey (B. & S.), Ltd.	Ord.	5/-	11/-
Newall Engineering Co., Ltd.	Ord.	2/-	7/-
Newman Industries, Ltd.	Ord.	2/-	7/-
" "	6% Prf. Ord.	5/-	5/-
Noble & Lund, Ltd.	Ord.	2/-	5/6
Norton, W. E. (Holdings), Ltd.	Ord.	2/-	9/6xd
Osborn (Samuel) & Co., Ltd.	Ord.	5/-	53/-xd
" " " "	5½% Cum. Prf.	£1	22/-
Pratt (F.) Engineering Corporation, Ltd.	Ord.	5/-	15/6
Sanderson Kayser, Ltd.	Ord.	10/-	34/3
" "	6½% Cum. Prf.	£1	16/3
Scottish Machine Tool Corporation, Ltd.	Ord.	4/-	7/9xd
Shardlow (Ambrose) & Co., Ltd.	Ord.	£1	52/6
Shaw (John) & Sons, Wolverhampton, Ltd.	Ord.	5/-	13/10½
Sheffield Twist Drill & Steel Co., Ltd.	Ord.	4/-	21/9xd
" " "	5% Cum. Prf.	£1	13/3
Stedall & Co., Ltd.	Ord.	5/-	7/6
Sykes (W. E.), Ltd.	"B" non-voting Ord.	10/-	24/4½
Tap & Die Corporation, Ltd.	Ord.	5/-	18/-
" " "	4½% Deb. 1961-1977	Stk.	81½
Wadkin, Ltd.	Ord.	10/-	26/-
Ward (Thos W.), Ltd.	Ord.	£1	62/6
" "	5% Cum. 1st Pref.	£1	13/6
" "	5% Cum. 2nd Pref.	£1	20/-
Willson Lathes, Ltd.	Ord.	1/-	2/6

The Middle Prices given in the list are in several cases nominal prices only and not actual dealing prices. Every effort is made to ensure accuracy, but no liability can be accepted for any error. * Sheffield price. ‡ Birmingham price.

PRICES OF MATERIALS

All prices per ton except where otherwise stated

Pig Iron* (10 tons or over)

Foundry and Forge No. 3, Class 2

Middlesbrough	£21 17 0
Birmingham	£21 9 3

Phos. Over 0·1 up to 0·4%

Birmingham	£23 5 0
Grangemouth	£23 10 0

Hæmatite

N.E. Coast (made in N.E.)	£23 19 0
Scotland (made in Scotland, zone S.1.)	£24 5 6
Sheffield	£25 9 0
Birmingham	£25 13 0
S. Wales (made in Wales)	£23 19 0

Steel Products*

Medium plates (50 tons and over)	£43 16 6
Mild steel plates, ordinary (50 tons and over)	£40 7 0
Boiler plates (50 tons and over)	£42 17 0
Flat bars, 5 in. wide and under (50 tons or over)	£39 1 0
Round bars, under 3 in. (50 tons or over)	£39 1 0
Billets, rolling quality, soft U.T. (100 tons or over)	£31 15 6

Phosphor Bronze

Ingots (2B8) (A.I.D.) d/d	£312 0 0

Copper

Cash (mean)	£233 0 0
Cold rolled and hot rolled sheets 4 ft. by 2 ft. by 10 SWG	£303 15 0
Rods, $\frac{9}{16}$ in. to $\frac{3}{4}$ in. diam.	£321 10 0
Tubes, $1\frac{1}{2}$ in. bore by 10 SWG, ton lots, per lb.	3s. $1\frac{1}{2}$d.
Wire rod, black, hot-rolled ($\frac{1}{2}$- $\frac{9}{16}$ in.), English	£244 17 6

Zinc

Refined, minimum 98 per cent purity, current month (mean)	£71 10 0

Brass

Tubes, solid drawn, basis per lb.	1s. $9\frac{1}{2}$d.
Strip 63/37, 6in. by 10 SWG coils, ton lots	£253 5 0—£256 5 0
Rods, $\frac{1}{2}$-3 in. diam. (59 per cent copper)	2s. 0d.

Yellow Metal

Condenser plates, per ton	£184 0 0
Rods, per lb.	2s. 1d.

Aluminium

Ingots, min. 99·5 per cent Canadian d/d	£186 0 0

Tinplates

**U.K. Home trade: Cold reduced, f.o.r. makers works (15-50 tons)	£3 7 $8\frac{1}{2}$
U.K. Export: Cold reduced basis, f.o.r. works port	73s. 6d.—76s. 0d.

Gunmetal

Ingots, B.S. 1400 L.G.2, delivered	£209 0 0

* Subject to increase of 1 per cent.

**Subject to allowances and extras.

MAKERS' PRICES

Hexagon Steel Bars[1]

Sizes in inches from 1 in. up to 2·21 and 2·41 a/f ex works, 2 tons basis	£42 17 6†
Free cutting black	£46 14 6†

Reeled Steel Bars[1]

Single-reeled, $1\frac{1}{2}$ in. upwards, f.o.t. works (+ usual extra for sizes)	£43 9 0†
Free cutting	£47 7 0†

Precision-ground Mild Steel[2]

1-in. diam ± 0·00025-in. 4-ton lots, per cwt. 124s. 6d.†

Bright Ground Stainless Steel Bars[2]

EN56AM (martensitic, free cutting)	£304 10 0
EN58AM (austenitic free cutting)	£377 10 0

Prices are basic, subject to extras.

High-speed Steel

Black random length bar. All prices basic, per lb., subject to extras:

Molybdenum " 66 "	6s. 4d.
Molybdenum " 46 "	6s. 2d.
14 per cent tungsten	6s. $6\frac{1}{2}$d.
16 per cent tungsten	6s. 11d.
18 per cent tungsten	7s. 3d.
22 per cent tungsten	8s. 7d.
5 per cent cobalt	10s. 4d.
4·75/5·25 molybdenum + 6·0/6·75 tungsten + 1·75/2·05 vanadium per cent (5-6-2)	6s. 6d.

Precision-ground, High-speed Free-turning Brass Rod[2]

$\frac{1}{4}$-in. diam. ±0·00025-in., 2 ton lots, per lb. 2s. $7\frac{1}{2}$d.

Grey Iron Rod

Die Cast[4] in random lengths 18 in. to 26 in. rough machined $\frac{1}{32}$-in. above listed size. Extra for definite lengths. Discounts for orders over £150.

	Per cwt. net. Mark I	Mark III
$\frac{3}{4}$ or $\frac{7}{8}$ in.	260s. 3d.	338s. 3d.
1 or $1\frac{1}{8}$ in.	208s. 4d.	267s. 3d.
$1\frac{1}{4}$ to $1\frac{1}{2}$ in.	146s. 3d.	181s. 7d.
$1\frac{5}{8}$ to 2 in.	112s. 7d.	133s. 6d.
$2\frac{1}{8}$ to $3\frac{1}{8}$ in.	97s. 1d.	112s. 9d.
$3\frac{1}{4}$ to 12 in.	91s. 9d.	105s. 3d.

Continuous Cast

Centreless machined, 10-ft. lengths 1 to 3-in. diam. + 0·010 to 0·020 in., prices as quoted for die cast bar[4]

Centreless ground +0·010 in. (Extra for hardenable alloy iron)[5]	1 or $1\frac{1}{8}$ in.	208s. 4d.
	$1\frac{1}{4}$ to $1\frac{1}{2}$ in.	146s. 3d.
	$1\frac{5}{8}$ to 2 in.	112s. 7d.
Per cwt. net.	$2\frac{1}{8}$ to $3\frac{1}{8}$ in.	97s. 1d.

Stellite[6]

Welding Rods, plain

$\frac{1}{4}$ in. diam., per lb. 30s. 0d

Toolbits

$\frac{1}{4}$ in. sq. × 4 in., each 22s. 3d.

[1] Colvilles, Ltd., Glasgow, and 17 Grosvenor Street, London, W.1. [2]Pratt, Levick & Co., Ltd., Chester. [3] Spartan Steel & Alloys, Ltd., St. Stephens Street, Birmingham, 6. [4] Sheepbridge Alloy Castings, Ltd., Sutton-in-Ashfield. [5]"Flocast," Harold Andrews Sheepbridge, Ltd., Halesowen. [6]Deloro Stellite, Ltd., Swindon Road, Stratton St. Margaret, Swindon.

† Plus 1 per cent.

BASIC PRICES FROM LONDON STOCK[a]

Free Cutting Steel

Bright cold drawn: (Usaspead) over 1 to 2 in.	£59 4 6‡
Lead bearing (Usaled)	£63 11 0‡
Precision ground, $1\frac{1}{8}$ in.	£84 14 6‡

Bright Drawn

M.S. bars (M.M.C.) over $1\frac{1}{4}$ to 2 in.	£56 10 0‡
Square edge flats (Useflat)	£73 6 6‡
M.S. angles (Usaspead)	£100 6 6‡
Case hardening (EN) (Usacase) over $1\frac{1}{4}$ to 2 in.	£62 10 0‡
M.S. bars (EN3B) (Usamild) over $1\frac{1}{4}$ to 2 in.	£58 16 6‡
Carbon manganese semi-free cutting case hardening (EN202) (Usaspead 202) over $1\frac{1}{4}$ to 2 in.	£71 5 0‡
35/45 ton tensile (EN6) (Usen) over 1 to $1\frac{1}{4}$ in.	£67 3 0‡
0·4 carbon normalized (Usaspead " 40 ") over $1\frac{1}{4}$ to 2 in.	£69 5 0‡
0·45 carbon normalized EN9 (Usaspead 55)	£69 15 0‡
Carbon manganese steel to Specification EN16T (Usaspead 5565), per ton	£127 1 6

Ground Flat Stock

18-, 24-, and 36-in. lengths (Usaspead). List prices plus 10 per cent less 5 per cent.

Oil Hardening Cast Steel

Non-shrink (Usaspead N.S.O.H.), $\frac{1}{4}$ in. to $2\frac{1}{2}$ in. per lb.	1s. 11d.
Non-distorting heavy duty (Usaspead H.C.H.C.), $\frac{1}{4}$ in. to $2\frac{1}{2}$ in., per lb.	4s. 2d.

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(0·194-in. to $1\frac{1}{4}$-in.).

Genuine Stubs quality, per lb.	4s. 10d. less 27½%
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Stainless Steel

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Glacier Machined Bronze Bars

Phosphor bronze (2B8) / Lead bronze } Prices on application

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18 per cent tungsten. Prices on application

Toolholder bits:

Usaspead "Super" / " "Supreme" / " Cobalt 10 } List price

Shimstock

Steel assorted, per tin	3s. 6d.
Brass " "	7s. 3d.

[a] Macready's Metal Co., Ltd., Pentonville Road, N.1. Subject to confirmation by London Office. Delivered free by van in London area.

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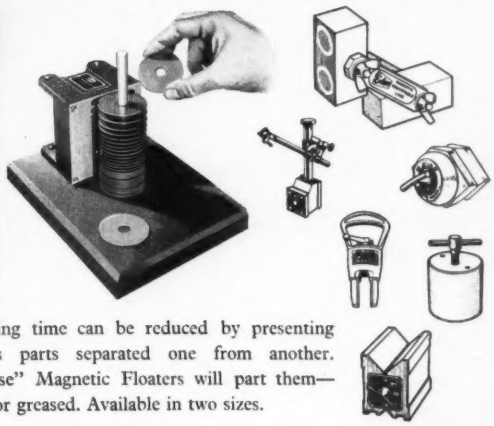
Speed the handling of ferrous sheet with

MAGNETIC FLOATERS



Handling time can be reduced by presenting ferrous parts separated one from another. "Eclipse" Magnetic Floaters will part them—clean or greased. Available in two sizes.

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PM177

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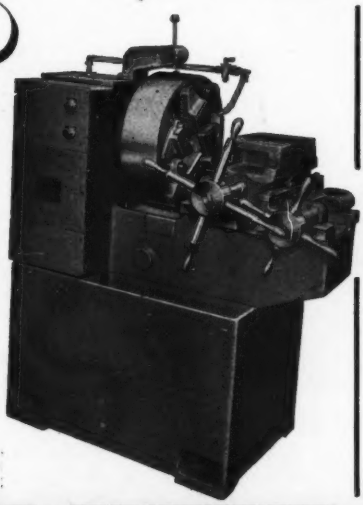
PATENT SCREWING MACHINES

Heaps Universal Screwing Machines are a range of General Purpose Screwing Machines widely used in general Engineering Workshops & Collieries and in the maintenance departments of factories, etc., where the quantities of each class of screwing do not warrant the installation of the Automatic Diehead type of machine.



4" UNIVERSAL SCREWING MACHINE

This machine is fitted with a Stationary Tangential Diehead and Dies of High speed steel can be supplied for almost any type of thread. The vice is of the self-centring type with double jaws for the large sizes. Final drive to the main spindle is through a worm and worm wheel. Speed changes are obtained through "pick-off" gears.

Capacity:

Pipes ..... ¼in. to 4in.

Bolts ..... ¼in. to 2in.

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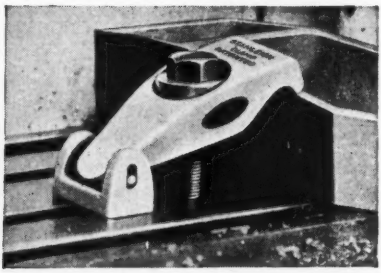
J & S-STANLEIGH

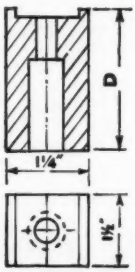
machine clamps . . .



SIZES AND CAPACITIES

Size No....	4	6	8
Length of clamps... ...	4in.	6in.	8in.
Width of clamp	1¼in.	2¼in.	2¼in.
Ball washer for bolt size	⅛in. or ¼in.	¼in. or ⅜in.	⅜in. or 1in.
Capacity (height adjustment) without packing block	2in.	2½in.	3in.

J & S—Stanleigh Universal Clamps are a practical and economical aid to increased production. They are manufactured in three standard sizes to give 2in., 2½in. and 3in. height adjustments. The clamps are fully universal, making a perfect clamping contact at any height from zero to the maximum capacity and allow up to 15 degrees tilt all the way up by simply tightening a nut, which does not distort the bolt.



PACKING BLOCKS

PACKING BLOCKS

Three standard sizes of screw-on-packing blocks are manufactured to enable the height adjustment of the clamp to be increased
Size (D): 1in., 2in. and 3in.

Stocked by all J & S small tool distributing agents.

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The choice is yours. 'Lazmet' Boronised Blasting Nozzles mean fewer changes, less labour costs, longer life, lower price . . . "In the fifteen months they have been in operation we have used them on two machines working day and night and have only used eight nozzles, which is far better than anything we have previously attained" writes a satisfied user—typical of many.

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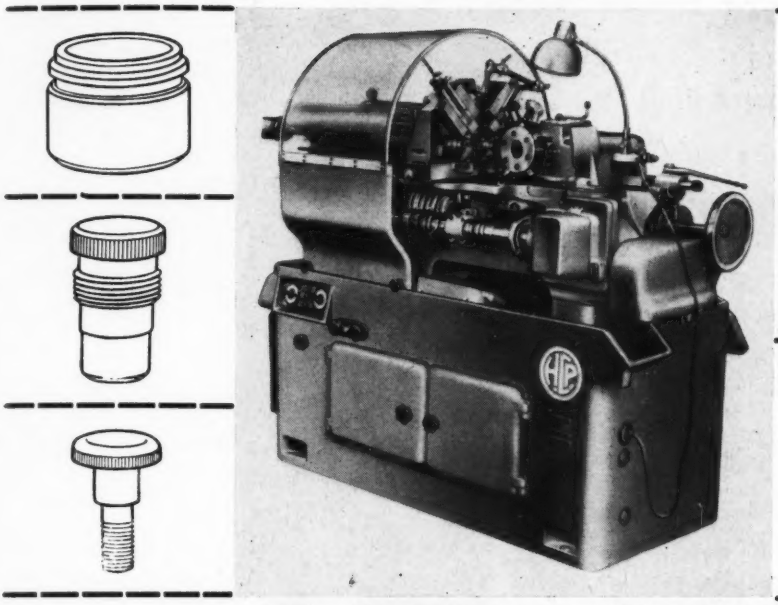

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HIGH PRECISION ROLLER BEARINGS ON SPINDLE
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2 TOP SLIDES
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CAPACITY-AUTOMATIC BAR FEED
1½ in. DIA. × 4 in. LONG

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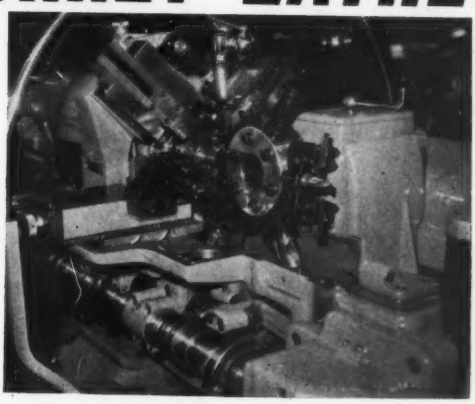

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2 out of 3

minutes saved!

Typical application of S.P.K. MA1 Hydro Pneumatic Drilling Machine fitted with standard S.P.K. 6-spindle Adjustable Centre Head. Drilling C.I. component with 6 holes ¼" diameter × 1⅛" deep.

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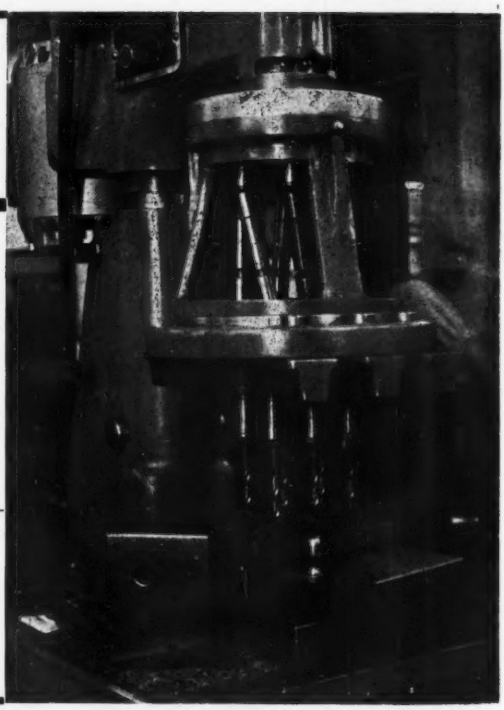

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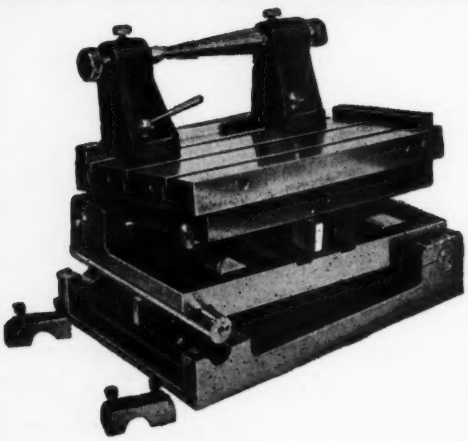

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NEW UNIVERSAL TYPE: ***MADE TO HINGE FROM EITHER END OF BASE PLATE TO ENABLE ALL COMPOUND ANGLES TO BE OBTAINED***

TYPE E.W.U/L. Face 11 in. × 7 in. £185 complete with 6 in. centres.

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Height at rest ..... 5 in.
10 in. and 5 in. Roller Centres.
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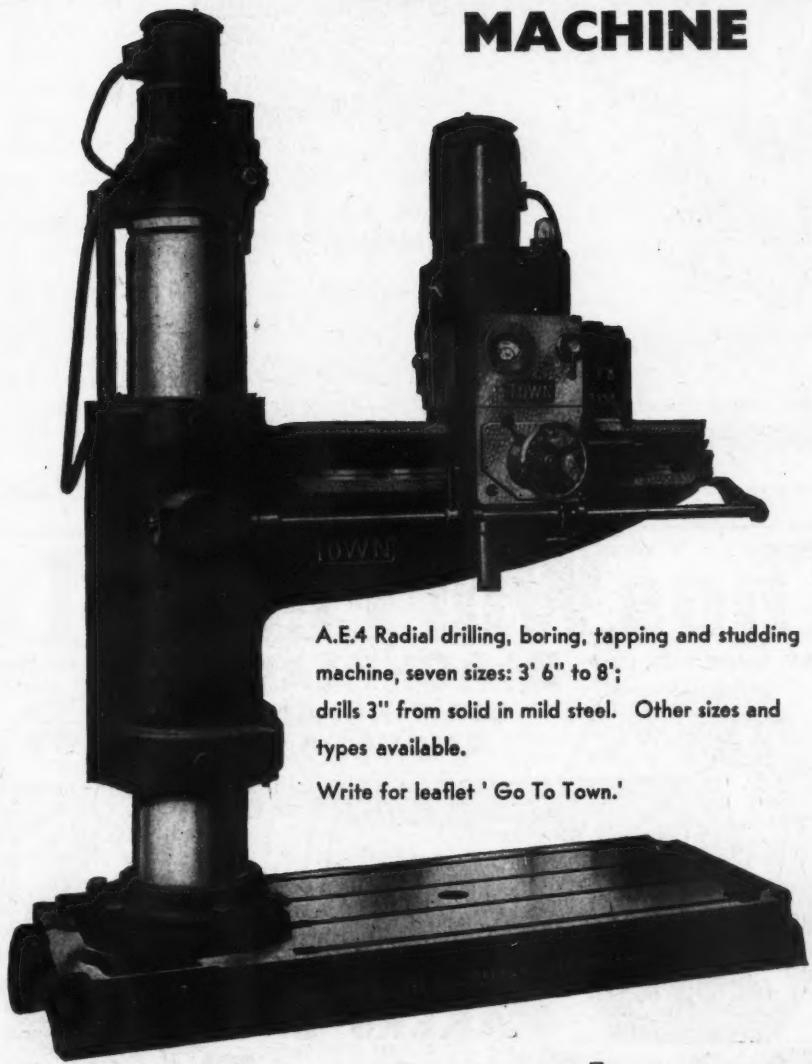

A.E.4 Radial drilling, boring, tapping and studding machine, seven sizes: 3' 6" to 8'; drills 3" from solid in mild steel. Other sizes and types available.

Write for leaflet ' Go To Town.'

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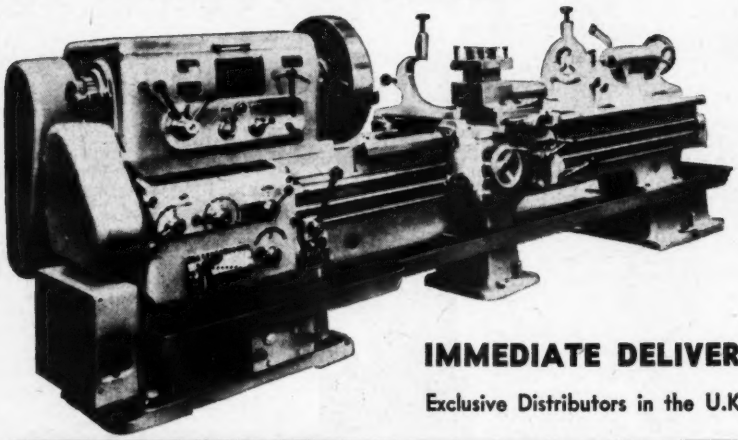

- 22" swing × 80 and 120 between centres.
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Exclusive Distributors in the U.K.

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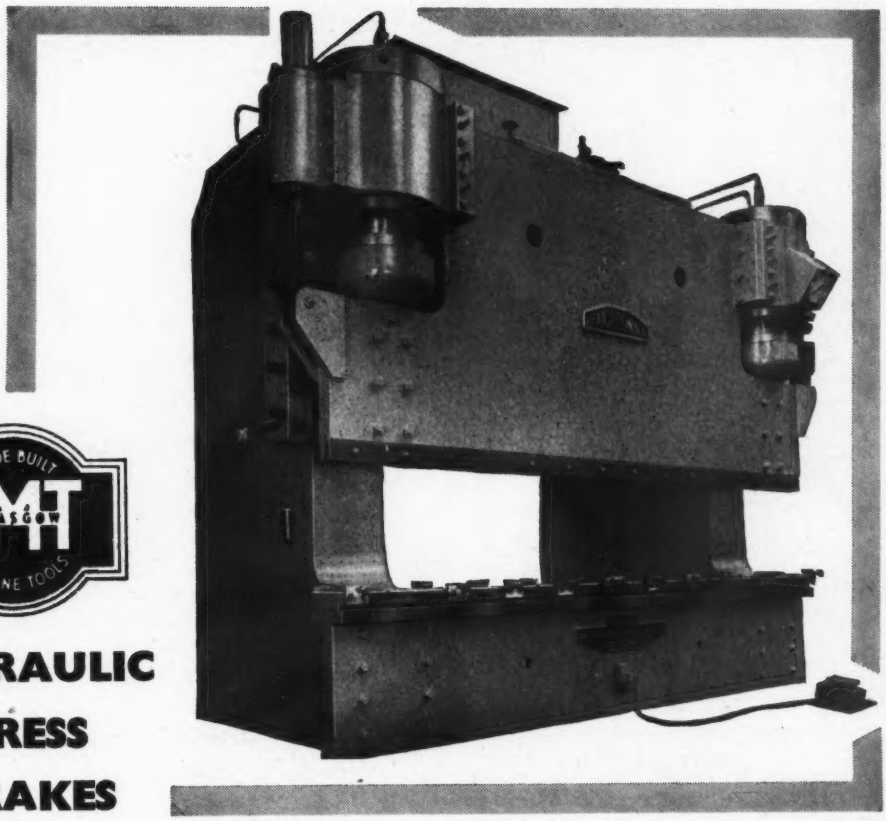

CLYDE BUILT SMT GLASGOW MACHINE TOOLS

HYDRAULIC PRESS BRAKES

The illustration shows one of our larger machines and its compact arrangement will be noted. The smaller machines have all-welded steel frames, whilst these larger sizes are built from massive steel fabrications bolted together. In both cases the slab forming the bed is checked on to the housings, so that the load is not transferred through the welding or the bolts, as the case may be.

Special attention is paid to the guiding of the slide and the guide members are very long, additional guides being provided at the top of the slide. All guides have adjustable gibs.

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Standard machines of the hydraulic type (we also build mechanical Press Brakes) are available up to 500 tons capacity and larger machines can often be designed to meet special requirements. Die lengths up to 18′ 0″ are normal and extensions can be provided at either or both ends of slide and bed.

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COMBINING THE FOLLOWING FEATURES —

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BUILT TO NPL SPEC.
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ADAPTABLE TO
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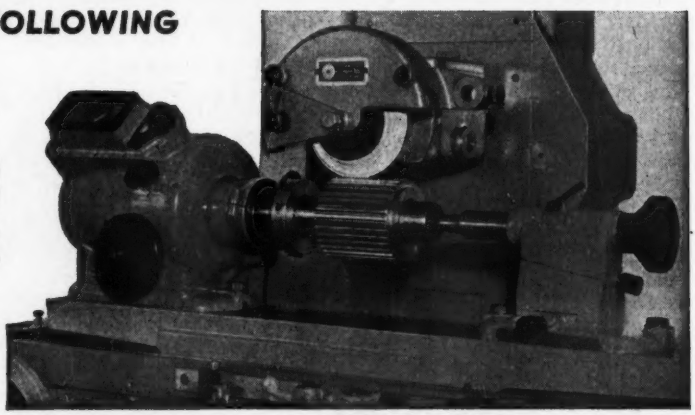

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B & T Hardened and Ground Jig Bushes. Over 7,000 standard sizes covering all drill and reamer sizes up to 2½in. diameter.

USE B&T ANCHOR BUSHING DRILL TEMPLATES

B & T Anchor Bushes are either welded or riveted to a thin steel or aluminium template thus providing a very low cost drill jig which is light to handle and which can be easily formed to suit any shape.

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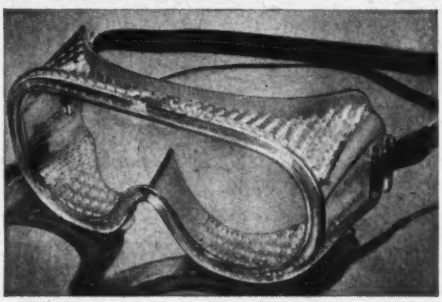

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Cobex REGD. for clarity

COBEX rigid vinyl is tough, non-inflammable and dimensionally stable. It resists most chemicals, including mineral acids and alkalis. It is produced in transparent and opaque colours as well as clear transparent and translucent white. There is also a special outdoor range of lightfast colours and a translucent ceiling grade. Cobex can be used in deep draw moulding, and vacuum or drape forming. It is joined by hot gas welding.

COBEX is supplied in sheet or calendered rolls, and extruded sheeting. There are also various multi-colour laminated sheets for engraving.

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* CLOSE TOLERANCES
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TOOLROOM VERSATILITY with

ROSENFORS

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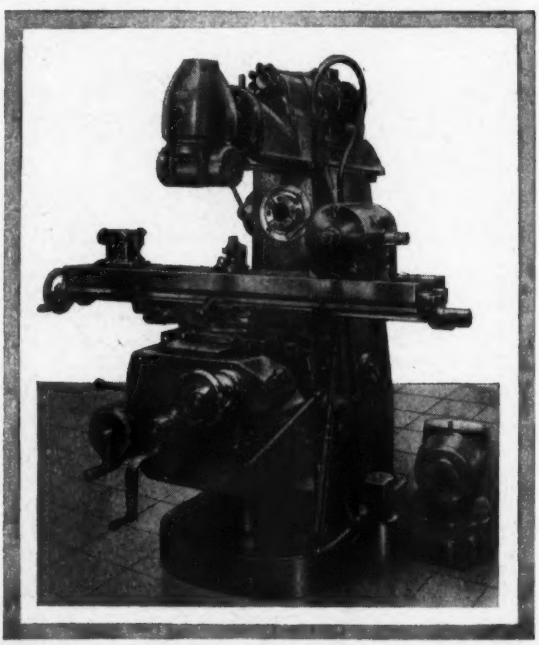
Illustrated is Model RFU Universal with Toolmaker's Overarm.



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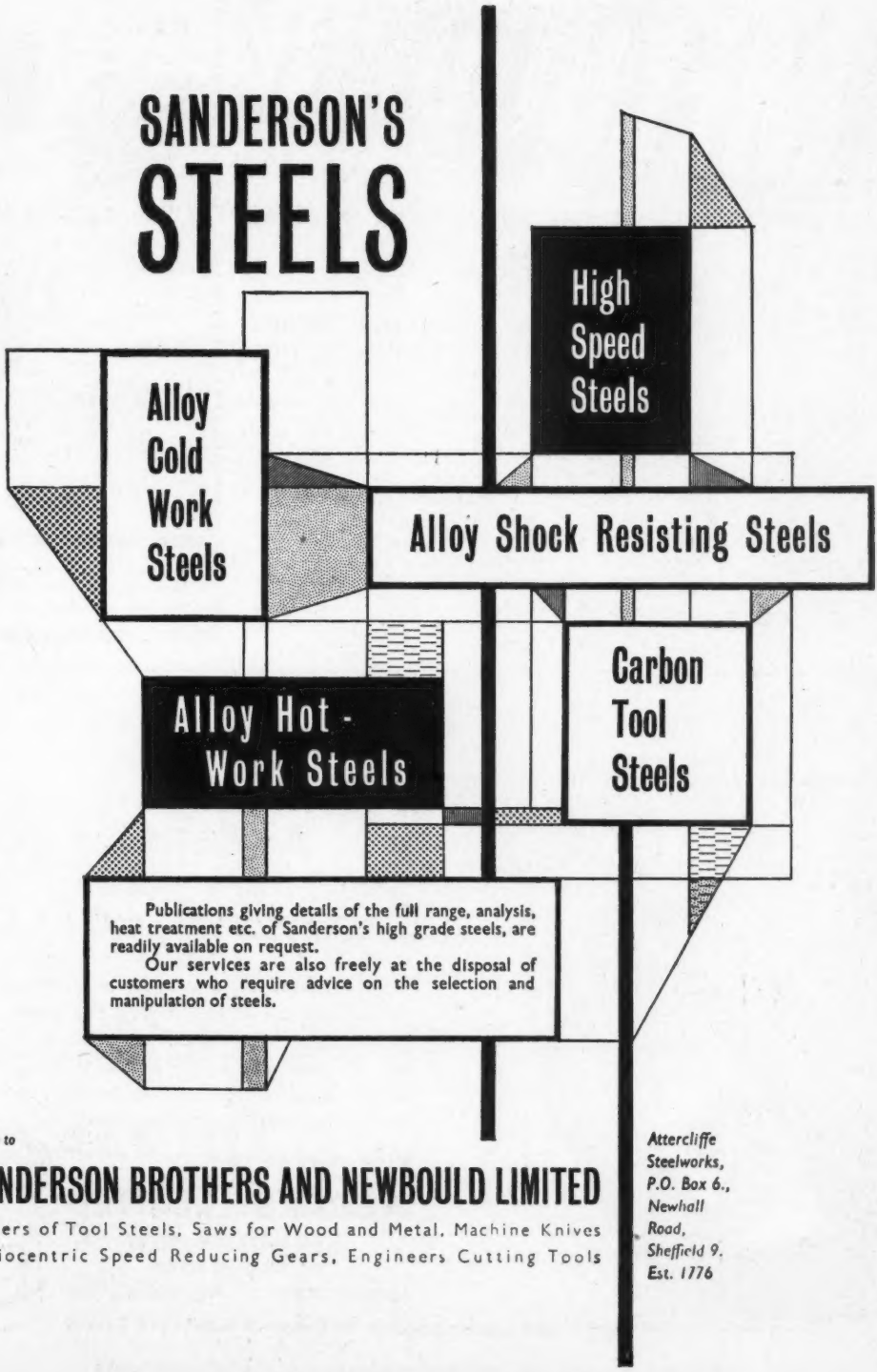

Publications giving details of the full range, analysis, heat treatment etc. of Sanderson's high grade steels, are readily available on request.

Our services are also freely at the disposal of customers who require advice on the selection and manipulation of steels.

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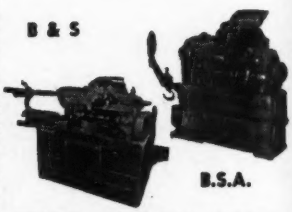

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Can now offer

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- All parts fitted are interchangeable with maker's spares.
- Reconditioning not only costs less than a new machine but can also be charged wholly as a maintenance expense ranking for full tax relief.
- We can loan a machine equivalent to the one taken out thereby assuring customer of his continuity of production.

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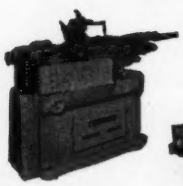

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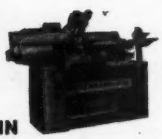

PETERMANN

C.V.A.

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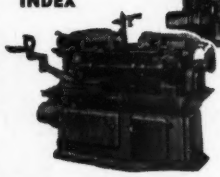

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(H. E. SLAWSON, M.B.E., M.I.P.E., Man. Director) Tel: MELBOURNE 232

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Crawford **COLLETS**

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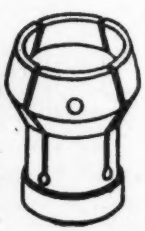

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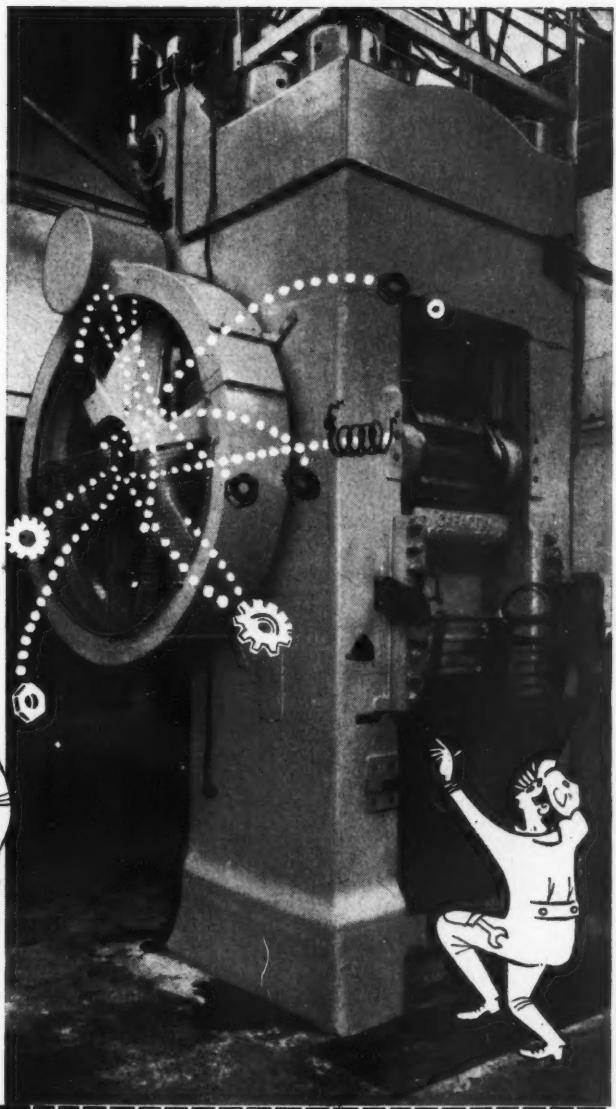

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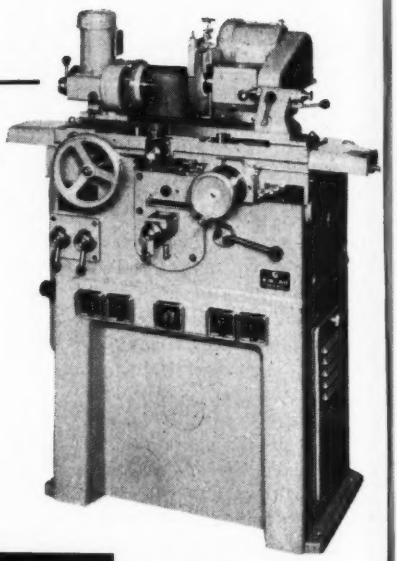

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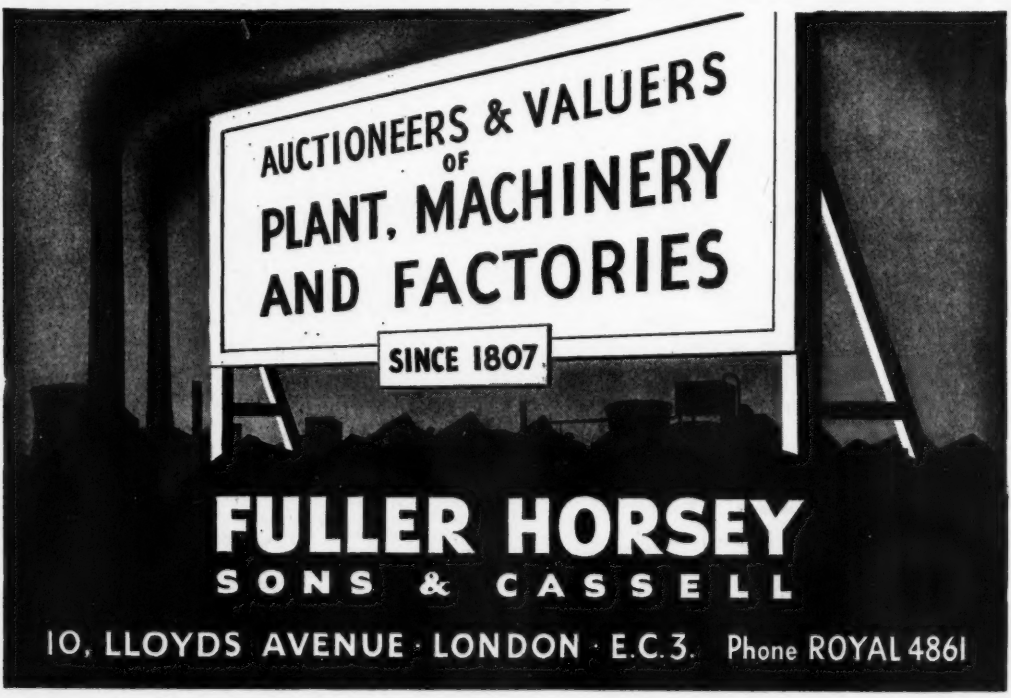

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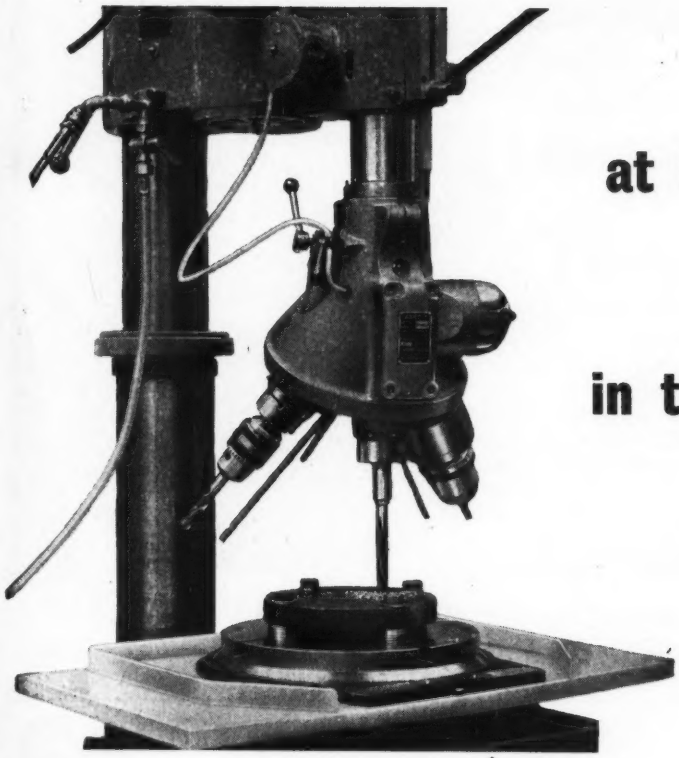

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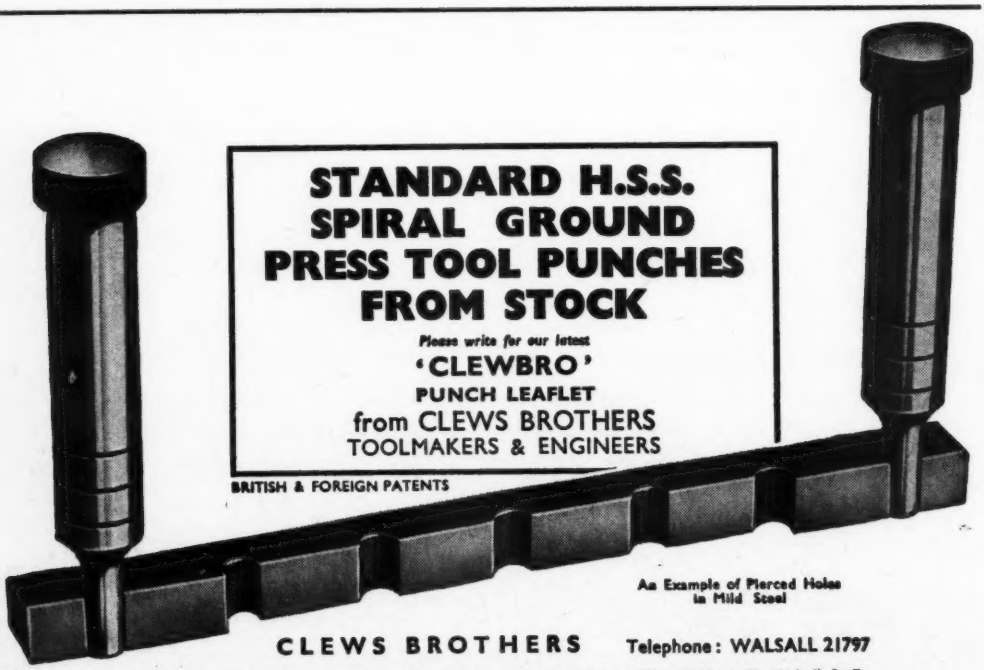

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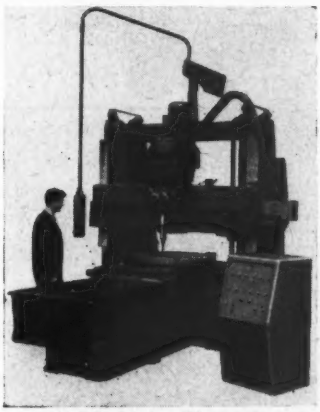

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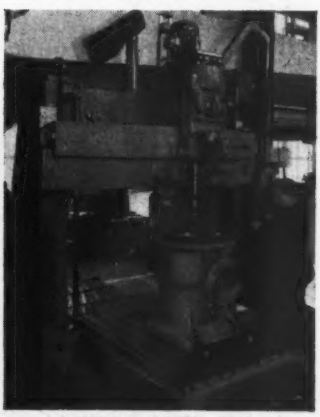

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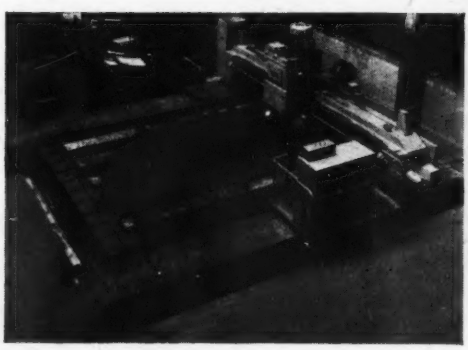

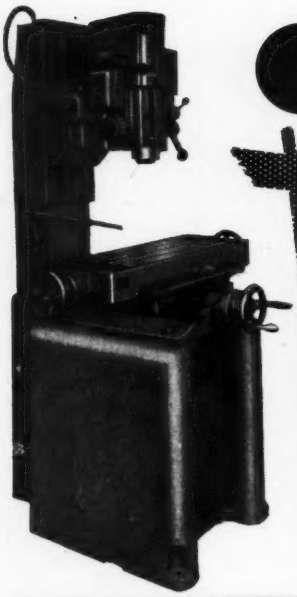

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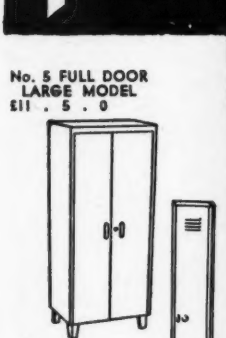

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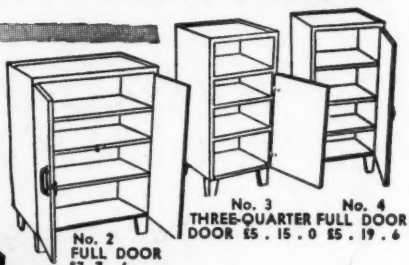

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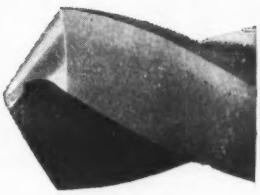

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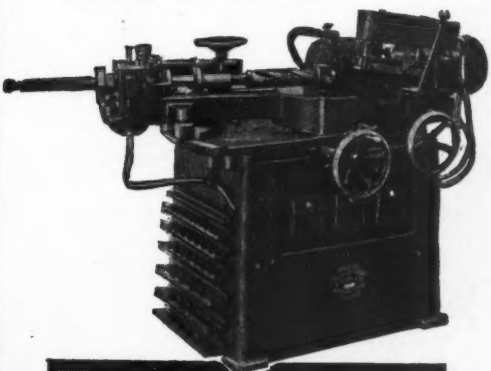

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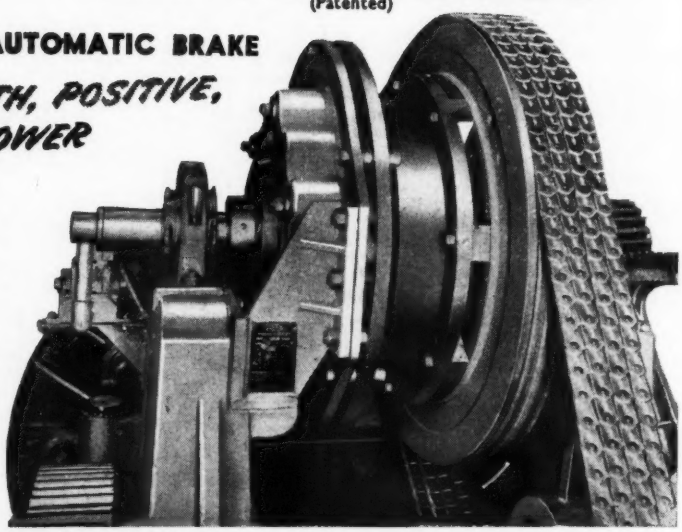

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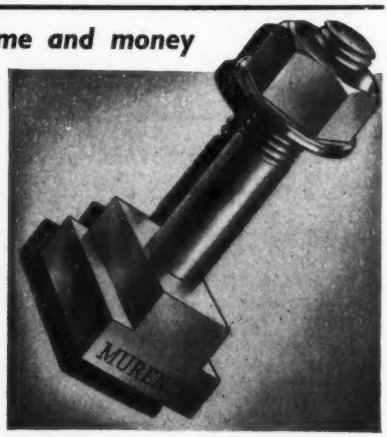

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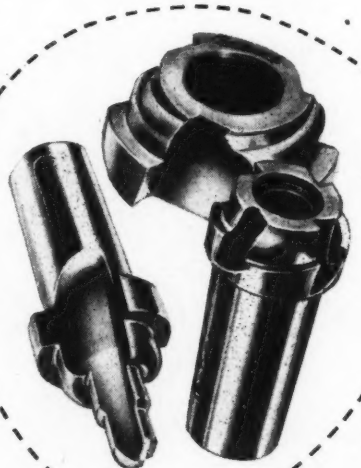

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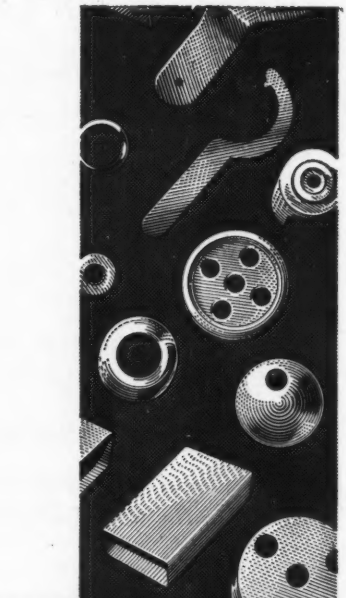

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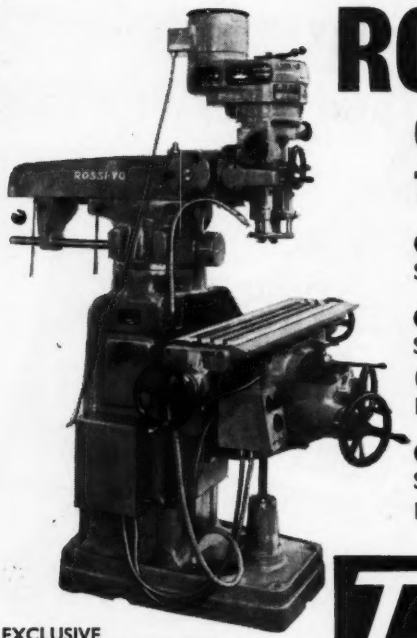

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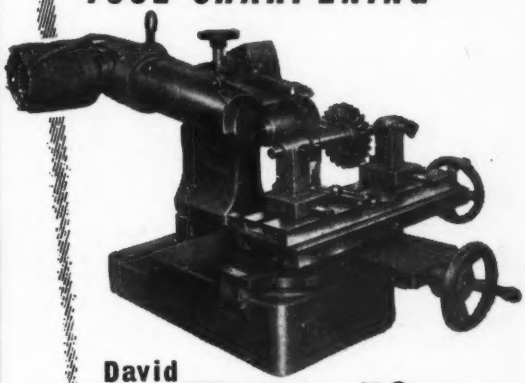

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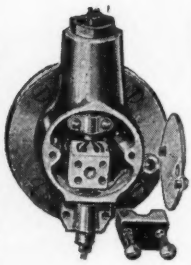

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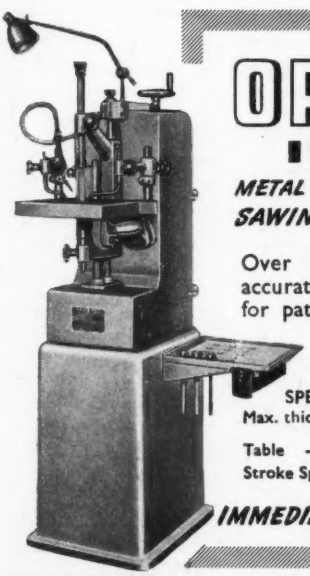

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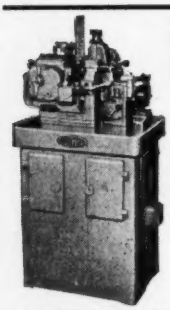

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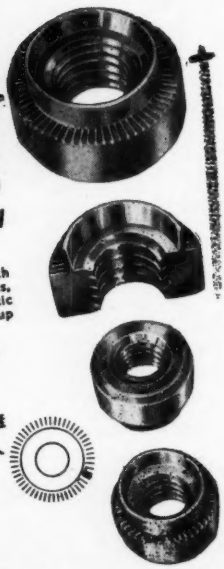

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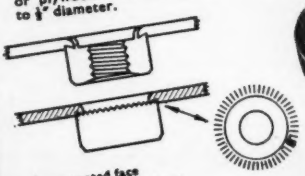

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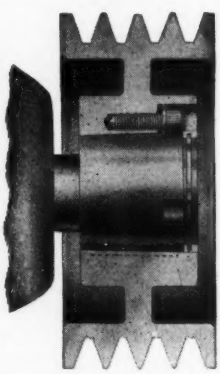

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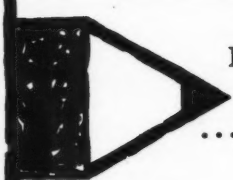

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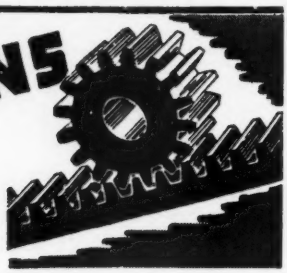

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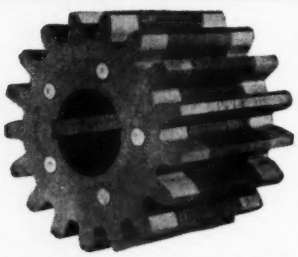

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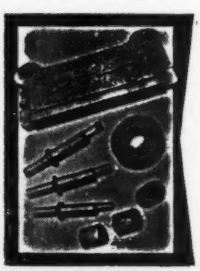

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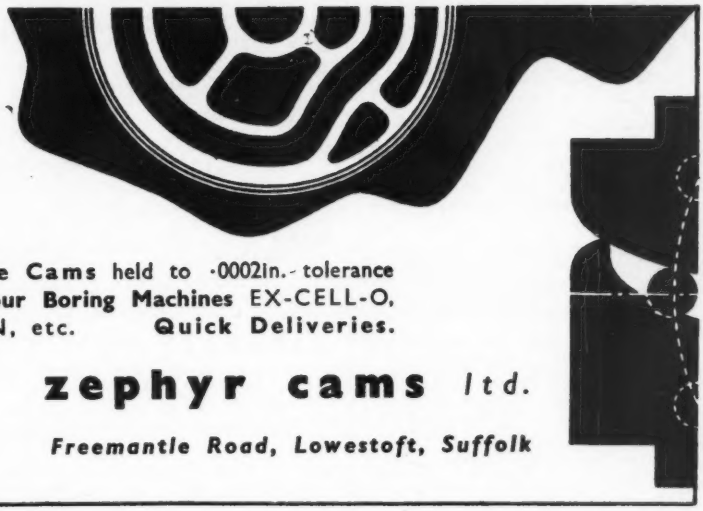

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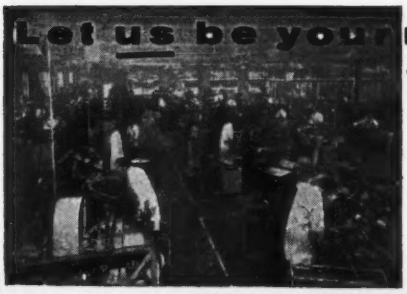

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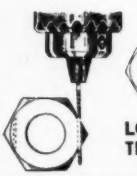

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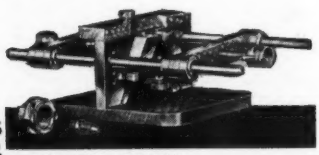

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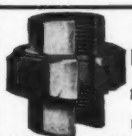

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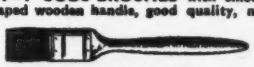

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Late Type Machine Tools
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Good Class Used MACHINE TOOLS
Write or phone
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We pay a good price.
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We pay cash for single machines or complete plants
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IMMEDIATE INSPECTION ARRANGED
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Vertical Head for Cincinnati 2M Horizontal Miller.—SCOTT ENGINEERING (BOURNEMOUTH), LTD., Stone Lane, Wimborne, Dorset. Wimborne 1173.

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C.V.A. No. 12 automatic, ¾in. cap., gears barfeed, excellent cond., also No. 8, cap. ¼in., good cond.—C. L. THOMAS, LTD., Stirling Road, Solihull. Tel.: 3075-6.

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OLDFIELD & SCHOFIELD 15in.
Heavy Duty S.S. & SC. Centre Lathe. 10ft. 6in. between centres. Swing over saddle 23in., swing in gap 50in. Spindle speeds 6·5 to 332 r.p.m.
Excellent condition.

NORTON Model 'C'
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All Geared Turret Type Single Column Vertical Boring & Turning Mill, with Side Head. Max. swing 43in. Table speeds 10 to 125 r.p.m.
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Dial Type Medium Speed Plain Horizontal Milling Machine.
Speeds 18 to 450 r.p.m. Fully rebuilt.

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CENTEC 2B Milling Machine, 400/440 volts.
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STAFFA Motorised 4in. Tube Bender, 400/440 volts.

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MITCHELL 8½in. × 9ft. bed, 400/440 volts. FEBRUARY, 1962.
VICTORIA U2 Rapidmil, 400/440 volts. MARCH, 1962.
COLCHESTER 'Student', 400/440 volts. MARCH, 1962.
COLCHESTER 'Triumph' 400/440 volts. MARCH, 1962.
COLCHESTER 'Mascot', 400/440 volts. APRIL, 1962.
COLCHESTER 'Chipmaster', 400/440 volts. MAY, 1962.

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Asquith, 4ft., No. 4 M.T.
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Wilson 12in. centres S.S. & S.C. Lathe, 12ft. between.
Herbert No. 4 A.G.H. Capstan Lathe, 6½in. centres.
Capstan Lathe, Morey, SG, 1in. × 6½in. bar capacity, 6 tool, 7in. centres.
Coulthurst Heavy Duty, 9½in. centres, S. & S. 2in. hollow spindle, 21in. between centres.
Mitchell 9in. centres, S.S. & S.C. 6ft. gap bed.
Barber 5½in. centres, S.S. & S.C. 2 way tool post, 21in. between centres.
A.C.E. 7½in. centres S.S. & S.C., 36in. between, Colchester Triumph, 7in. centres S.S. & S.C., 42in. between centres.

MILLING MACHINES
Ward Haggas No. 3 Universal, 9 spindle speeds.
Van Norman horizontal Universal, 9 spindle speeds.
Richmond vertical, 42in. × 12in. traverse, 6 spindle speeds.

GRINDING MACHINES
Churchill PBH Hydraulic Universal, table capacity 12in. diameter × 36in.
Norton tool and cutter grinder, 3 jaw chuck, 21in. between centres.

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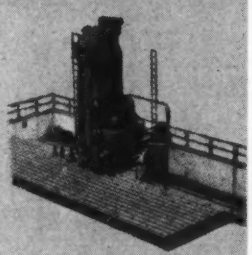

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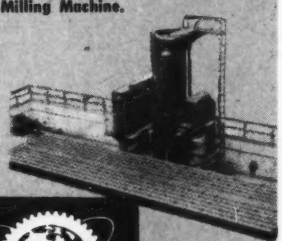

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VICTORIA V2 Vertical Miller, 1957.
GREENLEE 1in. 6-sp. Auto.
GREENLEE 1in. & 1¼in. 6-sp. autos. (2) 1946.
RYDER No. 6 Vertical Autos.
HEALD 46B, 49 (2) 47A Boremattics.
GORTON 9J Copy Miller, 1942.
NEW BRITAIN GRIDLEY 61 1¼in. and 2¼in. Six Spindle Autos. Late.
WICKMAN 1¼in. 5-Spindle Auto.
EDGWICK Type A 1611 Diecaster.
SIDNEY 36in. swing × 120 Lathe.
REED PRENTICE 1½ G Diecaster.
GRIDLEY 5in. and 2¼in. S.Sp. Autos.
ELECTRAULIC VBH. 15 ton Broach.
VICTORIA U3 Monotrol Miller, 1953.
CONOMATIC 8 sp. 1¼in. Bar Auto.
BROWN & WARD ¾in. and 1¼in. Autos.
WARD 2A and 3A Capstans.
CLEVELAND 1½in., 2in., 2½in. Autos.
Three **UNION** ¾in. Pedestal Drills. NEW.
BULLARD 16in. 6-sp. Mult-au-Matic, 1943
GLEASON 12in. Bevel Gear Generators (2)
FELLOWS 61A, 645A Gear Shapers.
BRYANT 16-38 Internal Grinder.
HEENAN-FROUDE Baling Press, 1947.
SCHULER Vertical Dieing Press.
HERBERT 8S Turret Lathe.
MILWAUKEE 2H Vertical and Plain Mills.
BLISS 304A 50 ton Press, 4in. stroke.
NORTON 14 × 72 Univ. Grinder.
DEFIANCE 25A Horizontal Borer.
NEWALL type L 10in. × 48in. Grinder, 1942
HEALD 72A Internal Grinders (2).
NORTON 12 × 36 Universal Grinder.
WARNER & SWASEY 5 and 2A Turrets.
PRATT-WHITNEY 12B 2-sp. Profiler. 1941.
EDGWICK No. 2 Universal Miller.
CHURCHILL No. 1 Planetary Grinder.
CRUTT HM24 Gear Grinder, 1944.
GISHOLT 1L, 2L Turret Lathes, 1941-43.
ARCHDALE 18in. and 30in. Vert. Mill, 1942.
MONARCH Copying Lathe, 1946.
BROWN & SHARPE No. 20 Pl. Grinder.
HERBERT Auto Juniors (3).
STANLEY 8½in. × 60in. gap. lathe.
EXCELLO 1212 Double end fine borer
CINCINNATI No. 2 & 3 Centreless Gears.
CHURCHILL Rigid Hobbers 130, 188.

All modern fully motorised machines.

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Production Miller, Olivetti knee- less auto-cycle, 27in. traverse, 44in. × 10in. table, used for demonstration only, 400/3/50, electrics.—C. L. THOMAS LTD. Stirling Road, Solihull. Tel.: 3075-6.

Classified Advertisements (*PLANT FOR SALE, contd.*)

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CARDIFF 8½in. S.S. & S.C. Gap Bed Lathe to admit 80in. between centres, approx. 2 years old (2 machines available).
SWIFT 12½in. S.S. & S.C. Gap Bed Lathe to admit 9ft. 0in. between centres.
MITCHELL of **HALIFAX** 7in. S.S. & S.C. Gap Bed Lathe to admit 3ft. 0in. between centres.
GRANOR 12½in. S.S. & S.C. Gap Bed Lathe to admit 12ft. 9in. between centres.
MITCHELL of **KEIGHLEY** 8½in. S.S. & S.C. Lathe to admit 4ft. 3in. between centres.
MITCHELL of **KEIGHLEY** 10½in. S.S. & S.C. Lathe to admit 4ft. 0in. between centres.
VOLMAN 8in. S.S. & S.C. Gap Bed Lathe to admit 4ft. 6in. between centres.

DRILLING MACHINES

New **PROGRESS** 4E and 5E Pillar Drilling Machines.
ARCHDALE 5ft. Elevating Arm Radial Drilling Machine, No. 5 M.T. spindle.
New **RICHMOND** Model SR2 3ft. 0in. Radial Drilling Machine. Fixed arm No. 3 M.T. spindle.
SWIFT 4ft. 6in. Model A1 Elevating Arm Radial Drilling Machine, No. 4 M.T. spindle, motorised 400-440/3/50 cycles.

GRINDING MACHINES

BROWN & SHARPE No. 5 Horizontal Spindle Surface Grinding Machine, 24in × 8in. capacity, hydraulic feed to table.
JONES & SHIPMAN Vertical Spindle Surface Grinding Machine, 18in. × 6in., hydraulic feed to table.
NORTON 6in. × 30in. Hydraulic Plain Cylindrical Grinding Machine, maximum wheel diameter 20in.

MILLING MACHINES

New **DENBIGH** D4 Horizontal Miller, 46in. × 10in. table.
HYPERMILL 7/27 Production Type Milling Machine, 43in. × 10in. table.
MIDGLEY & SUTCLIFFE Hand Lever Feed Milling Machine, 16in. × 5in. table.
EDGWICK No. 2 Dial Type Plain Horizontal Milling Machine, 46in. × 11in. table.
ARCHDALE 20in. Dial Type Horizontal Milling Machine, 40in. × 12in. table.
GREENWOOD & BATLEY Plain Horizontal Milling Machine, working surface of table 20in. × 10in.
EDGWICK 18in. Horizontal Plain Production Milling Machine, with 40in. × 12in. table.

POWER HAMMERS

ALLDAYS & ONIONS 2 cwt. Clear Space Type Pneumatic Power Hammer.
MASSEY 5 cwt. Pneumatic Side Type Power Hammer.

SAWING MACHINES

New **WICKSTEED** 10in. capacity Power Hacksaw.
New **STARTRITE-SABRE** Vertical Metal Cutting Bandsaw, 20in. throat.

SHEET METAL WORKING MACHINERY

RUSHWORTH 10ft. × ¼in. Pyramid Type Bending Rolls.

SLOTTING MACHINES

BUTLER 14in. stroke All Geared Slotting Machine with 39in. diameter rotary table.
DUTRANNOIT 24in. stroke Precision Slotting Machine, with swivelling head, 39½in. table.

SHAPING MACHINES

New **ALBA** 18in. and 24in. Shaping Machine.
New **INVICTA** 24in. and 18in. stroke Shaping Machines.

STRAIGHTENING ROLLS

BRONX 8ft. 0in. × ¼in. Straightening Rolls, 5 roll type.

All the above machines are motorised 400-440/3/50 cycles

JOHN CASHMORE LTD.
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NEW MACHINES FOR IMMEDIATE DELIVERY

AMC K1500 Crank Shaft Regrinder, swing-over table 19½in., max. crank throw 4in.

POLAK Die Casting Machines. Model CL085-8 Horizontal Plunger. Die Lock 85 ton. Capacity 2 lbs. aluminium. Model CLP85-15 Vertical Plunger. Die Lock 85 ton. Capacity 2 lbs. aluminium.

SCHMALTZ APR600 Horizontal spindle 24in. dia. Rotary Table Surface Grinder.

TOS Model FEK.80. Production Cam Milling Machine.

HDA. 80 Bridge Type Planing Machine. Capacity 10ft. by 31½in. by 29½in.

ELGAR MACHINE TOOL CO. LTD.

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Telephone: ACOrn 5555 (7 lines)

Fielding 50 ton Hydraulic Horizontal pipe bender, up to 6in. bore hydraulic tubes.
200 Ton Fielding Downstroke Hydraulic Press, 14in. ram, 42in. stroke, 63in. daylight.
100 Ton Fielding ditto, 10in. ram, 72in. stroke, 99in. daylight.
Fielding 50 ton Hydraulic Horizontal Pipe Bender for 6in. thick tubes.
Bliss 90 Ton Geared Press. 10in. stroke.
3 Bliss No. 304 Vertical Single Action Drawing Presses. 7½in. stroke, 50 tons.
30 Ton open front Geared Inclinable Press.
Windsor 6-oz. Plastic Injection Moulder.
Sedgwick 6ft. × ¼in. Folder.
6ft. × ¼in. Overcrank Guillotine.
7ft. × 1in. Craig Donald Flattening Rolls.
"Pyramid" Bending Rolls, 9ft. 0 in. × ¼in.
200 Ton Tangye Hydraulic Straightening Press, bed 25ft. × 3ft. stroke 21in., motorised travelling table, 2 ram pump.
Hugh Smith, Double Table Scarfing Machine, 13in. fixed stroke, from 16in. to 8ft. wide, 1½in. thick steel plates.
Crow, Harvey Punch. Shears and Angle Cropper, 18in. blade, 27in. throat, heavy duty.
Robertson Shears, ¼in. capacity, 10 h.p. 28in. blade, 9in. maximum opening. (Two).
Berry Plate Guillotine, capacity 4ft. × 1in.
New 1-cwt. and 2-cwt. Hammers by Massey and Alldays & Onions, also 3-5 cwt. secondhand E.O.T. Cranes.
30 Ton Marshall Fleming, 29ft. span, cab.
25 Ton Clyde, 21ft. 9in. span, cab control, 1954. Can convert any span to 95ft.
20 Ton King 42ft. 3in. span. Unused.
15 Ton Heywood, 34ft. span, cab control.
10 Ton Heywood, 34ft. span. Unused.
10 Ton Morris, 32ft. 10in., span, cab control.
10 ton Smith, 57ft. span, cab control.
5 Ton Matterson, 34ft. span, cab (three).
5 Ton Clyde, 42ft. 3in. span, floor control.
5 Ton. 37ft. span. 1944.
3 Ton Morris, 149ft. span. 1954.

FRED WATKINS (ENGINEERING), LTD. Coleford, Glos. 'Phone: Coleford 2271 (5 lines)

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CINCINNATI 12in. × 48in. Universal Grinder.
NEW 3½in. × 14in. Universal Grinders.
MATRIX 1A Universal Grinder, 9in. × 24in.
CHURCHILL 12in. × 36in. Hydraulic Universal Grinder.
CHURCHILL 16in. × 50in. Universal Tool and Cutter Grinder.
ABRASIVE 24in. × 8in. horizontal Surface Grinder, Model 3B.
LUMSDEN 18in. × 6in. Horizontal Surface Grinder.
PRATT & WHITNEY 36in. × 12in. Vertical Spindle Surface Grinder.
NORTON 36in. × 10in. Horizontal Spindle Production Surface Grinder.
GRAND RAPIDS No. 25 Hydraulic Horizontal Spindle Surface Grinder, 18in. × 6in. table. 20in. table traverse.
SNOW 20in. table Surface Grinders, Model T.20.
BRYANT No. 5 Internal Grinders, rebuilt.
RIVETT No. 104 Internal Grinder, 8in. swing.
BRYANT 16-38in. Internal Grinder, max. swing without guard 38in.
HEALD No. 72 Size-Matic Duplex Internal Grinder.
CHURCHILL, Model HBB Automatic Sizing Traverse Feed Internal Grinder, with Duplex spindles for hole and face grinding.
SMART & BROWN 1½in. capacity Internal Grinder.
BILLETER Twin-Head Radial Arm. Open Sided Hydraulic Sideway Grinder, table 9ft. 8in. × 2ft. 3in.
NORTON 10in. × 36in. Hydraulic Plain Grinder.
JACKMAN No. 28 53in. Horiz. Disc Grinder.
JACKMAN 24in. Vertical Double Disc Grinder.
ARTER 16in. Rotary Piston Ring and Surface Grinder.
KITCHEN & WADE No. 2 Vertical Honing Machines; stroke 0-in-11in; bore 1in-6in.
KITCHEN & WADE V9 Honing Machine, capacity ⅛in. to 2in. × 5in. long.
DELAPENA Model 301 cabinet stand Honing Machine, capacity 0.120in. to 3.125in., with assortment of wedges, adaptors, mandrels and stones.
LUMSDEN 14in. × 3in. 4-wheel Grinder.
B.S.A. 12-5 Centreless Grinder, 5½in. capacity.
HUNT ½in. and 2in. Twist Drill Grinders.

KEY SEATERS

EDGWICK No. 1 Vertical Automatic Key Seating Machine; capacity ½in. × 20in.
BENTLEY Keyseating and Slot Drilling Machines; cotter head traverse 4½in.; table traverse 13½in.
ASQUITH Horizontal Keyseating and Cotterway Machines; table 18in. × 5in., 2in. stroke.

CAPSTAN AND TURRET LATHES

WARD No. 7 Capstan Lathe with ball chuck and bar feed equipment.
BARDONS & OLIVER No. 5 Universal Turret Lathe, swing 18in. over bed, 2½in. hollow spindle.
GISHOLT 2L Turret Lathe, swing 22½in. over bed. 4½in. hollow spindle, chasing saddle, cross sliding turret.
WARD No. 7 Combination Turret Lathe, swing 14½in., dia., 2in. ball chuck, chasing saddle.
HERBERT No. 7 Combination Turret Lathe, 16½in. swing over bed; 2½in. hollow spindle, well equipped.
WARNER & SWASEY No. 3A Turret Lathe. 23½in. swing, 4½in. hollow spindle, taper turning attachment.
HERBERT No. 21 Combination Turret Lathe, swing 33½in. over bed, 7½in. hollow spindle.
WARD No. 3A Motor Driven Capstan Lathes with ball chuck and bar feed equipment.

GENERAL LATHES

NEW 12in. Centre Gap Bed Lathes, 80in between centres; 15 to 550 r.p.m.
WILSON 9½in. Gap Bed Lathe; 7ft. 6in. between centres, 33in. gap; 3½in. hollow spindle.

359-361, EUSTON RD., LONDON, N.W.1
Telephone: EUSton 5000 Telex No. 24264
And at Lansdowne House, 41, Water St. Birmingham, 3. *Telephone: Central 7606-8*

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HELMET ROW, OLD STREET, LONDON, E.C.1

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ALL MACHINES MOTORISED FOR 3 PHASE SUPPLY UNLESS OTHERWISE STATED

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GREENLEE 1in. × 6 spindle.
PETERMAN No. 0.
BORERS (Horizontal)
KEARNS No. 2.
BROACHING
AMERICAN model H2, stroke 30in.
CAPSTANS
MURAD ¾in.
HERBERT 4, Ball Chuck.
CUTTING-OFF MACHINES
TAYLOR 10in.
DRILLS
NATCO 24 spindle No. 1 M.T.
CORONA Type 15CX 2 spindle.
HERBERT 2 spindle. Type V.H.
DENBIGH 24in. B.G.
HERBERT "C" Power Feed.
CORONA 1AX, No. 1 Morse Taper.
LELAND GIFFORD 2-sp., No. 2 M.T.
HERBERT Type B. Single Spindle, ¼in.
CORONA 6MX Cluster Type.
HERBERT Type H, ¾in. cap.
CORONA 9FX ½ Capacity.
BOLEY Multi Spindle.
ENGRAVERS
LIENHARD 3-dimensional. (New.)
HUPFIELD Router.
T.T. & H. Type C, C.B. and M.A.
T.T. & H. Multi Etcher.
FILING AND SAWING MACHINES
MIDSAW 22in. Bandsaw.
JONES No. 13 Bandsaw.
RAPIDOR 6in. Hacksaw.
RAPIDOR Filing and Sawing.
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Sheet Edging, 30in. × 22g.
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UNIVERSAL Horiz. Borer, Trav. Spindle.
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CAPSTAN AND CENTRE LATHES

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WARD 7B Combination Turret Lathe.
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HETTNER Radial Drilling Machine, 10ft. elevating arm.

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ORCUTT Model HM24 Hydraulic Internal Gear Grinder.
GLEASON 3in. Straight Bevel Gear Generator.

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CHURCHILL Plain Cylindrical Grinding Machine, 26in. swing × 84in. between centres (1951).
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SWEENEY & BLOCKSIDGE 50 ton cap. Power Press. Adjustable Stroke.
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JOHES & SHIPMAN Straightening Press. Model PIG. 85.
BLISS No. 18 10-Ton Power Press.
BESCO No. 18 10-Ton Power Press.
DENBIGH No. OA Kick Press.
SMART & BROWN H.5 Toggle Press.

SAWING MACHINE

MELBO 6in. Cap. Hacksaw.

THIS LIST DOES NOT INCLUDE THE MANY NEW MACHINES THAT ARE AT PRESENT IN OUR SHOWROOMS AT HIGH WYCOMBE. WHY NOT VISIT US TO INSPECT OUR RANGE?

A. DOUGLAS CO., LTD.,
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LINCOLN ROAD, HIGH WYCOMBE, BUCKS.
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BROWN & SHARPE No. 2 Universal Milling Machine. Motor drive 5 h.p. 400/440 volts, 3 phase, 50 cycles. Table 46in. by 10in. 16 Spindle speeds 40–1,300 r.p.m. With vertical milling attachment, slotting attachment, rotary milling table, universal dividing head, tailstock, chuck, change gears, and other equipment.

R. O'Shaughnessy

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Kitchen & Wade G.5 4ft. Girder Radial Drilling Machine in new condition. 3 Speeds and 3 Feeds. Further details from:
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SERVICE **EDWARDS** VALUE!

TAYLOR & CHALLEN No. 3GDP. Geared Double Sided Double Action Cam drawing Press. Punch stroke 7in. Blankholder stroke 3½in. Between uprights 20½in. Blankholder 12in. diameter. With 8in. diameter hole. Arranged motor drive 400/440/3/50. Automatic press guard.

NEW **PEDEGESS** Percussion Riveting Machine. Model NH8. Capacity ⅛in. rivet shanks. Gap 6¾in. With table and thick support. Arranged motor drive 400/440/3/50.

RHODES 100-ton Geared Double Sided Press. Stroke 2½in. Width between side frames 20in. Bed 19½in. × 23½in. Hole in bed 14in. × 14½in. Arranged motor drive 400/440/3/50.

RHODES No. 21 45-tons Geared Inclinable Power Press. Detachable front tie bars. Stroke 2in. Centre to back 9in. Bed 28½in. × 18½in. Hole in bed 16in. × 12in.

TAYLOR & CHALLEN No. 6GDP Double Sided Double Action Geared Toggle Drawing Press. Punch stroke 19in. Blankholder stroke 11in. Blankholder 30in. diameter with 22½in. diameter hole. Between side frames 38½in. Weight about 17 tons.

NEW SECO Mode R. 72in. × ¼in. Power Guillotine. Depth of gap 6in. Automatic hold-down and all gauges. Arranged motor drive 400/440/3/50. Weight about 12¼ tons.

BENNIE Motorised 4-Roll Plate Bending & Straightening Machine. Capacity 4ft. × ¼in. Diameter of roller 7¼in. Top roller bearing swings out to enable complete cylinders to be withdrawn. Gearbox drive. Arranged motor drive 440/3/50.

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Harry Kirk Eng. Ltd.

can recommend the following modern quality machines from STOCK

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WICKMAN 5in. Chucking Automatic.
RYDER Verticalauto, capacity 16in. swing × 8in., 6 spindles.

BORING MACHINES

KEARNS O.B. Horizontal Boring Machine, 2½in. Spindle. Spindle speeds 15/600 r.p.m. Excellent condition.
JONES 6in. Spindle Horizontal Borer-Table 17ft. 6in. × 8ft. Spindle travel 48in. Rapid traverse 84in. per min. Motorised 400/3/50. Weight 70 tons
BULLARD 36in. Vertical Boring Mill.
KITCHEN & WADE Vertical Fine Boring Machine, 14in. stroke. Compound table.

DRILLING MACHINE

ARCHDALE 8-Spindle Hydraulic Vertical Drilling Machine.

GRINDING MACHINES

BROWN & SHARPE No. 5 Surface Grinder, 10in. throat.
BROWN & SHARPE No. 2 Surface Grinder, 18in. × 6in. table.
HEALD No. 172 Gap Bed Internal Grinding Machine, maximum diameter of component 36in.

LATHES

N.D. 8in. × 6ft. S.S. & S.C. Lathe, 30in. between centres.
NOBLE & LUND Heavy Duty Centre Lathe, 22in. centre height × 29ft. between centres. Max. swing over saddle 33in. dia.
HARVEY Heavy Duty Centre Lathe, 42½in. centre height × 52ft. between centres. Max. swing over saddle 5in. dia.

MILLING MACHINES

EDGWICK No. 2 Universal Milling Machine. Working surface of table 38in. × 7½in.
BROWN & SHARPE No. 3A Universal Milling Machine with Vertical Head Attachment. Spindle speeds 30/1,200. Power feed all movements.
COLLET & ENGLEHARDT Keller Type Die Sinking Machine. Model FKf80 capacity 60in. × 30in.

PLANING MACHINES

CLEVELAND Openside Planing Machine, capacity 10ft. × 2ft. 6in.
CINCINNATI Planing Machine, capacity 8ft. × 2ft. 6in.

MISCELLANEOUS MACHINES

Hydraulic Vertical Internal Honing Machine (manufactured by PETER WOLTERS). Capacity 0.2in. to 2in.
RAPIDAN Double Helical Gear Generating Machine, 12in. diameter capacity.

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MINGANTI 20/40 Turret Lathe. 42-1,650 r.p.m. Well equipped.
WARD 3A Ball Chuck Bar Feed and Chucking Machines. Very good selection of equipment also available with machines.
HERBERT No. 4 Capstan, speeds up to 511 r.p.m. Well equipped.
BOLEY & LEINEN S.R.26 High Speed Multi Tool Turret Lathe. 1in. capacity, 42/2,400 r.p.m.
SWIFT Profile Copy Lathe. 18in. × 5ft. 6in. Speed range 10-600 r.p.m. Excellent condition.
LANG 8in. × 9ft. S.S. & S.C. Lathe. 9-450 r.p.m. Spindle Bore 2¼in.
LANG 8¼in. × 24in. S.S. & S.C. Lathe, 19-900 r.p.m. Spindle bore 2¼in., 5 h.p.
LANG 10in. × 60in. S.S. & S.C. Lathe. 10-500 r.p.m. Spindle bore 2¼in. 12½ h.p.
PROGRESSIVE Lathe 10in. centre height. 40in. between centres. Gap bed. 30in. dia. swing. 12 speeds 17-750 r.p.m. Well equipped.
CINCINNATI 8-18 Tool and Die Milling Machine. 185-3,330 r.p.m. Equipped with slotting attachment.
CINCINNATI 1-18 Production Mill.
VICTORIA U.2 Universal Milling Machine. Table 45in. × 11¾in. 25-900 r.p.m., with Universal Milling Attachment and Dividing Head.
VICTOMATIC 30in. Production Milling Machine. 30-1,100 r.p.m.
EDGWICK Horizontal and Vertical Mill. 11in. × 46in. table, 24-405 r.p.m. Horizontal Vertical Milling attachment, 42-680 r.p.m.
KENDALL & GENT Vertical Mill. Table 19in. × 69in. Speed range 20 × 300 r.p.m.
PRATT & WHITNEY 12B Profile Mill. Twin spindles. 225-2,880 r.p.m.
DOWDING V.8 Gear Hobber. Capacity 6in. dia. Maximum pitch hobbed in one cut 14 d.p. Hob traverse 7¼in., 6-400 teeth. Well equipped.
FRORIEP KE.10 Vertical Boring and Turning Mill. 47in. swing. 39in. diameter, four-jaw chuck. Taper Turning attachment.
BUTLER 14in. Slotter, 6 speeds, 4in. to 14in. stroke. Table diameter 39in., 12½ h.p.
"VOA-55" Jig Borer. Table 32in. × 20in. 16 speeds 35-1,500 r.p.m.
No. 18 BLANCHARD Vertical Surface Grinder. 36in. dia. chuck. Capacity 36in. dia. × 12in. high.
CHURCHILL 30in. × 36in. Heavy Plain Cylindrical Grinding Machine. Capacity 30in. dia. × 36in. between centres.
NOVAMATIC Model "A" Hydraulic Automatic Internal Grinder. Capacity 10mm. to 120mm. dia.
EXCEL No. 1 Pedestal Model Surface Grinder.

SINGLE PILLAR AND BENCH DRILLS ALSO IN STOCK.

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One Secondhand Scrivener No. 1
Centreless Grinding Machine, maximum capacity 1¼in. diameter with Plunge Feed. Hand Operated. Motorised 400-440/3/50.

C. & G. OLDFIELD, LTD.,
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Churchill 12in. × 36in. Universal
Grinder complete with all Equipment and Internal Grinding Spindle.
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SOAG

SPECIAL PRICE—
BEFORE WE MOVE IT!

KITCHEN & WADE Type H3 Horizontal Boring and Milling Machine. Year of manufacture 1953.

In new condition.
Spindle dia. 3½ in.
Speed range (36) 8.5-800 r.p.m.
Main motor 7½-h.p.

Complete with motorised 72in. dia. Rotary Table.

This machine is still on its original foundation and is offered at a special ex situ price. It is in new condition.

Inspection by appointment.

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Tel.: RELiance 7201.

Gordon Try Ltd
MEMBER OF THE B.A.M.T.M.

SIMMONDS 12in. by 66in. Gap Bed	£450
SOUTHBEND 6¼in. by 36in. S. Bed	£325
WARD 7 Comb. Turret.	£250
HERBERT 2SS Chucker.	£325
HERBERT 9 Comb. Turret.	£350
SOUTHWARK No. 2 Capstan.	£275
NERO ⅜in. Collet Capstan.	£175
PITTLER R.B. 36 Capstan.	£250
ACME 4 Spindle Bar Auto.	£450
P. & G. 5D Chuck Auto.	£425
HERBERT 3 Chuck Auto.	£250
VICTORIA UO Univ. Nearly new	£895
ARCHDALE 20in. Horl. unused.	£950
OLIVETTI FP Plano type.	£1,150
MILWAUKEE 2K Universal.	£1,250
RICHMOND O.1 Universal.	£250
CINCINNATI 1-12 Production.	£550
HERBERT 15S Vert.	£525
ASQUITH Profile Mill.	£450
LE-BLOND Tool & Cutter.	£450
CATCO No. 2 Surface.	£155
J. & S. Tool and Cutter.	£425
WICKMAN Auto Cutter.	£275
HUNT No. 2 Drill.	£225
B. & S. No. 13 Universal	£575
LANDIS 10in. by 30in. Uni.	£750

THE CAUSEWAY, EGHAM, SURREY
Tel: Egham 4166/7

USED MACHINES

FOR IMMEDIATE DELIVERY

CHURCHILL 10in. × 24in. Universal Grinding M/c with Internal Spindle.
SNOW Hexagon and Square Bar Grinder up to 8in. square cap. with bar feeds.
AVERY Dynamic Balancing Machine.
CHURCHILL Model HBB Internal Grinder.
LANG 18in. swing Surfacing & Boring Lathe.
PALLAS Model H.O. Miller. Table 30in. × 8in.
CINCINNATI No. 2 Centreless Grinder.
HERBERT No. 1 Hand Milling Machine.
ARCHDALE 18in. Plain Horiz. Miller.
UNIVERSAL Magnetic Chuck with effective area of 60in. × 7in.
MIDSAW 20in. Bandsaw with brazing attach.
SKODA 40 Single Spindle Automatic. 1¼in. cap.
STIRK 20ft. × 6ft. × 6ft. Open side all electric Planing Machine.
KITCHEN & WADE Column Drill, No. 5 Morse Taper.
WILSON 7½in. × 3ft. 6in. Gap Bed S.S. & S.C. Lathe.
MOTCH & MERRYWEATHER 30in. Cold Sawing Machine.

All machines motorised 400/3/50.

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AUTOMATICS

BUTTERWORTH 1¼in. Good equip. 1958.
MANURHIN TR12-16 ⅝in. Auto.
BROWN & SHARPE OG Auto. £650.

DRILLING MACHINES

BRIMSDOWN. 2 Spindle. £65.
PROGRESS 4E, 1¼in. cap. (2). £195.
CORONA 1¼in. 4ft. Radial. £285.
DENBIGH. 1¼in. cap. £125.

GRINDERS

THOMPSON Hydraulic Surface, Type 'F," 18in. × 6in. £750.
SCRIVENER No. 1 Centreless. £650.
SMART & BROWN Internal. £225.
MYFORD MG9 Cylinder, with internal. £425.
VICTORIA Cyl., 4¼in. × 8in. As New. £425.
EXCEL No. 2, 14in. × 6in. Surface. £385.
PALLAS 18in. × 6in. Surface. £275.
NORTON 18in. × 7in. Hyd. Cyl. £295.

CAPSTANS AND LATHES

COLCHESTER 7in. × 42in. Triumph. £365
HERBERT No. 7 Comb. Turret. £685.
HERBERT No. 9 Comb. Turret. £225.
WARD 3A. B/Chuck, B/Feed. £685.
WARD 3A. Chucking (2). £650.
WARD 2A. B/Chuck, 2,041 r.p.m. £475.
WARD 2A. B/C, B/F Tooling. As New. £750.
SMART & BROWN 4in. Model "L." B/F. £225.
ACCURATOOL 4in. Capstan. £225.
AKUMA 9in. × 36in. Lathe. G.B. £195.
STUDENT 6in. × 24in. Good equip. £425.
DENHAM 4in. × 18in. Good equip. £165.
WILLIE RAPID 4¼in. × 18in. Good equip. £125.
HERBERT SMALLPIECE 6in. × 24in. £850.
DARLING & SELLARS 10¼in. × 12in. £650.
JOHNSTEAD 5ft. 6in. Facing Lathe. £650.
WILSON 7¼in. × 36in. Full equip. £285.
WARD No. 7 Capstan Lathe. £550.

MILLERS (Horiz. and Vert.)

ARCHDALE DUPLEX. 45in. × 11in £350.
ADCOCK & SHIPLEY 1VM Vert. £575.
SENIOR MI. 26½in. × 6in. £195.

POWER PRESSES AND SHEET METAL MACHINES

TAYLOR & CHALLEN 40 ton Dial Feed.
BLISS 21. 40 Ton. 8in. stroke. £425.
BESCO 6ft. × ⅛in. Guillotine.
BESCO 40 Ton. Adj. stroke and bed. £425.
BESCO 28 Ton. 2in. stroke. £225.
BESCO 8 Ton. A.P.X. Adj. stroke. £140.
BESCO 4 Ton. Adj. stroke. As New. £125.
MORGAN 6ft. × 14 S.W.G. Folder. As New. £200.
MIDSAW Hyspeed 36in. Fusion Cutter. £485

MISCELLANEOUS

G. H. ALEXANDER Engraver, with rotary table. £175.
ROWLAND 4in. Abrasive Cutter. £150.
THIEL Punch Shaper. As New. £575.
WICKSTEED 10in. × 10in. Powersaw. £195.
RAPIDOR 8in. × 8in. Powersaw. £95.
TAYLOR 12¼in. Spinning Lathe. £385.

Other machines in stock

WE SELL | **WE BUY**

EXCHANGES WELCOME | **HIRE PURCHASE ARRANGED**

New for Immediate Delivery
CENTEC Model 2B Precision Milling Machine. Power feed to table.
Further details from:—
C. & G. OLDFIELD, LTD.,
15, Abercorn Street,
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Brown and Ward automatics, 3 and 4 operation, sizes from ⅝in. to 1¼in., barfeeds, equipment, good cond., C. L. THOMAS LTD., Stirling Road, Solihull. Tel.: 3075-6.

Job Timing Clock, magneto electric, for 1-16 jobs, time clock-in card type. New. Price £37 10s.—BOX D462, MACHINERY, Clifton House, Euston Road, N.W.1

K·E·N·T

CAPSTANS

Ward 2C. late machine First class.
Ward 3A, good condition, late machine.
Murad 1in. power feed. 1960 machine.
Boley & Leinen SR26 1 1/16in. capacity.
Ward 2A air collet chuck.
Herbert 2S 1¼in. bar cap.
Herbert 4BS

LATHES

Colchester Triumph 7¼in., as new.
Betts Bridgeford 14in. × 16ft.
Le Blond "Regal" S.S. & S.C. 6¼in. × 24in.
Graham & Normanton surfacing and boring. 44in. swing in gap.
Le Blond "Regal" S.S. & S.C. 8in. × 36in.
Lang S.S. & S.C. gap bed. 12¼in. × 14ft. swings 45in. in gap.

MILLING MACHINES

Herbert No. 1 horiz. 16in. × 5in. table.
Herbert No. 10 vert. 25in. × 6¼in. table.
Asquith 2 spindle profile mill.
Archdale 14in. horiz. 29in. × 8¼in. table.
Rigid 12¼in. horiz. built-in telesc. brace.
Archdale 20in. horiz. Very good condition.

PRESSES

Weingarten 30 ton, open fronted, inclinable.
Raskin R5A 60 ton, only one still available.
Raskin R4 50 ton, UDAL guards, only 3 left.
Edwards B.A.19, 18 ton, adjust. stroke, Inc.

GRINDERS

Rowland 14in. heavy duty, wet & dry grinding.
B.S.A. centreless No. 7 3/8in.-3in. capacity.

AUTOS

Brown & Sharpe O.G. Single Spindle ⅛in. cap.
Index OR 12 Single spindle bar feed, tooling.
C.V.A. No. 8 single spindle ¼in. capacity. Very good.

DRILLS

Pollard 12AX 5 spindle. JACOBS chucks & guards.
Pollard 12AX 2 spindle bench drill, JACOBS chucks etc.
Herbert single spindle sensitive pillar drill.
Jones & Shipman 2 spindle vertical flanged motor.
Storey 25 pillar. Good machine.

VARIOUS

Sigma type Jig Borer and precision Milling and Drilling machine.
Invicta 18in. Shaper. Model 4M.
Heald 48A double headed 'Bore-matic'

All motorised 400/3/50

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RYDERMATIC 6-spindle Chucking Automatic. 12in. capacity.
PETERMANN 10 H.S. Chucking Automatic.
PARKSON 3K Horizontal Milling Machine with Vertical Head. Table 57in. × 12¼in.
HUGH SMITH 150-ton Hydraulic open-fronted Power Press.
INVICTA 6M Shaping Machines. Stroke 24in. 6 speeds 8-74 r.p.m. Tee slotted box table 23in. × 13in. × 13¼in. high.

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AUTOS

⅛ in. **WICKMAN.**
1¼in. **B.S.A.** Single Spindle 1942 machine.
1¼in. Model 61 **NEW BRITAIN.**
1in Model 60 **NEW BRITAIN.**
CONOMATIC 1¼in. 8-spindle Type W.W.
WICKMAN 2¼in. 5-spindle Auto. 1941 machine.

BORERS

GIDDINGS & LEWIS 25RT 17in. Facing Head.

DRILLING

PROGRESS 5E Round Table.
ARCHDALE 28in. Heavy Duty Pillar Drill.
NEW—**MAS** Model V.R.2 3ft Elevating Arm Radial Drill.
MAS Model V.R.4 4ft. 6in. Elevating Arm Radial Drill.

LATHES

DEAN, SMITH & GRACE, Height of centres 7in.
WARD 10 Combination Turret Lathe.
WARD 7 Combination Turret Lathe.
HERBERT No. 4 750 r.p.m. Draw in collet B/F.
DRUMMOND 5K 500 r.p.m. Chucking.
8¼in. **D.S & G.** 6ft. between st. bed.

MILLING

CINCINATTI 1/18 Production Mills.
CINCINATTI 3/36 Servo Hydro.
28in. **ARCHDALE.** Rapid all ways.
18in. **EDGWICK** Production Mill.
CINCINNATI No. 5 High Power Plain Hor. 1942 machine.
MILWAUKEE 2HL Vertical—rebuilt.
MILWAUKEE 2K Plain—overhauled.
PEGARD Bed Type Vertical, table 84in. × 29in.—slightly used.
NEW—**GIEWONT** Mode F.Y.C.25 No. 2, Vertical Miller, 44 × 10in. table Delivery mid-October.

GRINDING

LUMSDEN 70 LEOD Surface Grinder 1954
NEW—**BURDETT** Model 77 24 × 12in., Hydraulic Surface Grinder. Delivery April, 1962.
CHURCHILL No. 2 Centreless Grinder, wartime. £1.275.

SHEETMETAL

GUILLOTINES
RUSHWORTH 8ft. × ⅛in. Overcrank.
TRIUMPH 6ft. × ⅛in. Overcrank.
All machines motorised 400/3/50.

STANCROFT LTD

BEDWORTH ROAD, COVENTRY
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HERBERT No. 3S Capstan Lathe. Motor drive 400/440 volts, 3 phase. 50 cycles. Arranged for chucking.

HERBERT No. 2B Capstan Lathe. Motor drive 400/440 volts, 3 phase, 50 cycles. Arranged for chucking.

HERBERT N Junior Combination Turret Lathe. Motor drive 400/440 volts, 3 phase, 50 cycles. Arranged for chucking.

HERBERT No. 4 Capstan Lathe. Motor drive 400/440 volts, 3 phase, 50 cycles. With dead-length chuck, bar feed, square turret and back toolpost, turret tools.

HERBERT No. 9 Combination Turret Lathe, motor drive 400/440 volts, 3 phase, 50 cycles. Arranged for chucking.

R. U. Harry

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Classified Advertisements (*PLANT FOR SALE, contd.*)

HELIOT

35 GREENWICH CHURCH ST.
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WARD No. 2A Capstan Lathe. Chucking Machine, spindle bored 1¾in. diameter. Power feeds to turret, maximum swing 11¼in., maximum distance spindle to turret 17in. Spindle speeds 71-1531, r.p.m. £590.

WARD No. OE Capstan Lathe. ¼in. Bar capacity, collet chuck and bar feed, lever feed to cross slide and turret slide, spindle speeds 480-2,850 r.p.m. £225.

WARD No. 3A Capstan Lathe, chucking machine, spindle bored 1¾in. dia., power feeds to turret, maximum swing 13in., maximum distance spindle to turret 23in., spindle speeds 59-1,155 r.p.m. £625.

HERBERT 15S. Vertical Mill with sliding head, 49in. × 11in. table, 30in. table traverse. 8 Spindle speeds 51-700 r.p.m. £275.

WADKIN LXA. High speed vertical mill with sliding head 17½in. × 40in. table, 30in. table traverse, spindle speeds 1,100 and 2,200 r.p.m. £300.

ARCHDALE 2 Spindle pillar drilling machine. Spindles bored No. 3. Morse taper, 4 Speeds to each spindle, 25in. × 15¾in. rise and fall table, complete with coolant unit. £275.

CORONA 12.MX. 12 Spindle Cluster Drilling Machine. Maximum drilling capacity ¾in. Hand and Foot lever feed to table, 2 speeds to cluster head. 6¼in. Circular spindle carrier. £325.

CORONA 12.MX. As above but with 9in. Circular spindle carrier. (Selection of spindles available.) £325.

ARCHDALE 5ft. Radial Drilling Machine Low base, power elevating arm. No. 4 Morse taper spindle with tapping reverse, spindle speeds 40-2,000 r.p.m. Maximum spindle to base 56in. £875.

KEARNS No. 1 (Patent) Horizontal boring and facing machine, 2¼in. traversing spindle, 16in. Auto facing head, rapid and power feeds to all traverses, main table 36in. × 30in. Top table 30in. × 30in. Spindle speeds 10-600 r.p.m. Maximum distance spindle to outer support 4ft. £1,550.

RICHARDS No. 2 P.R.T. Horizontal Boring and Facing Machine. 3in. Traversing spindle. 22in. Auto facing head, rapid and power feeds to all traverses, main table 48in. × 30in. Top table 36in. × 36in. spindle speeds 3.5-300. r.p.m. Maximum distance spindle to outer support 5ft. 6in. £2,150.

All machines motorised 400/3/50.

ABA Type VL600 Jig Boring Machine fitted Optical Measuring device. Table 26in. × 16in. Spindle bored 4 M.T. 12 spindle speeds 31 to 1,400 r.p.m. 400/3/50. Complete with 16in. dia. Optical rotary table. Sine angle plate. Wet boring attachment, boring head, etc. Little Used Machine.

H.M.E. OP.55. Open Front, Ungeared, Power Press. 55 tons pressure. 4in. Stroke. Bed area 31in. × 23in. Bolster to guides 14in. Operator's Guards. Air balance to slide. 400/3/50.

TAYLOR & CHALLEN Type 958, Open Front, Geared, Power Press. 75 tons pressure. Bed area 31in. × 28in. Stroke 6in. Bed to guides, 12½in. Tie Rods, operator's guards. 400/3/50.

BUTTERLEY No. 10. Open Front, Geared, Power Press. 100 tons pressure. Adj. Stroke 1in. to 5in. Bed area 32in. × 26in. Bolster to guides 14½in. Tie rods, operator's guards. Worson Die Cushion equipment. 400/3/50.

JONES & SHIPMAN Model 1300/EIUR Universal 10in. × 27in. Grinding Machine. Rise and fall wheel head. Coolant pump and fittings. 400/3/50. Little used, with plenty of equipment.

CHURCHILL REDMAN 24ND Surfacing and Boring Lathe. Maximum swing 44in. dia. 16 speeds 14 to 408 r.p.m. Hole through spindle 3¼in. dia. Full range screwcutting. Taper Turning. 42in. dia. faceplate with jaws. 400/3/50.

KOLL Bandsaw, Vari. speed drive 33-2,376 r.p.m. Tilting table 24in. × 22in. Built in welding attachment. 400/3/50.

VICTORIA U1 Universal Miller complete with dividing heads and vertical attachment. Electric suds equipment. Latest type machine. 400/3/50.

STANCROFT LTD.,

LANCASTER STREET, BIRMINGHAM, 4

ASTon Cross 2235

WARD 2A Capstan Lathe. Motor drive 400/440 volts, 3 phase, 50 cycles. With automatic chuck and bar feed, square turret and back toolpost, certain turret tools, electric suds pump and fittings.

WARD 3A Capstan Lathe, as above.

WARD No. 8 Combination Turret Lathe. Motor drive 400/440 volts, 3 phase, 50 cycles. Fitted with three-jaw chuck.

R. O'Brien

4/6 Minerva Road, Park Royal, London, N.W.10

Telephone: ELGar 4841/4842

Herbert No. 7 Junior Capstan Lathe, Chuck Model, Spindle Speeds 45 to 767 r.p.m.
Further details from:—
C. & G. OLDFIELD, LTD.,
15, Abercorn Street,
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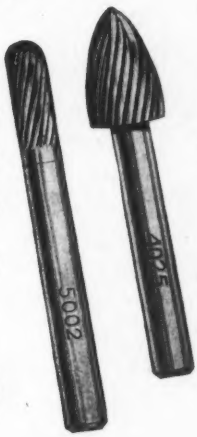

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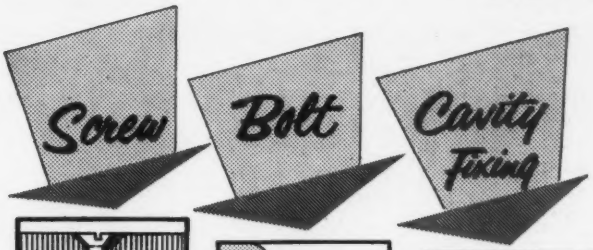

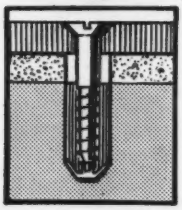

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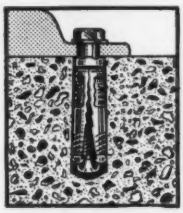

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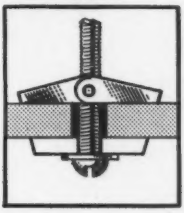

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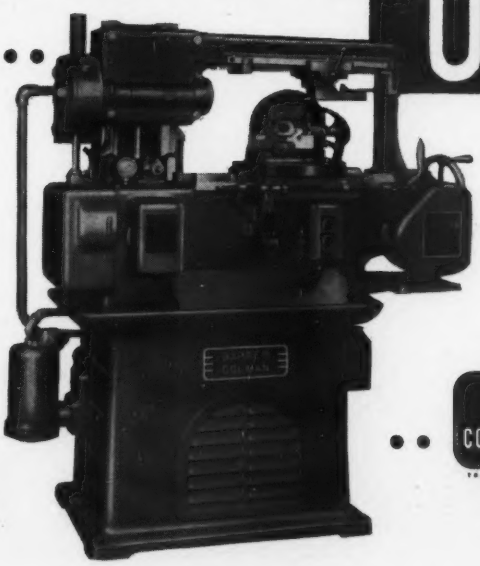

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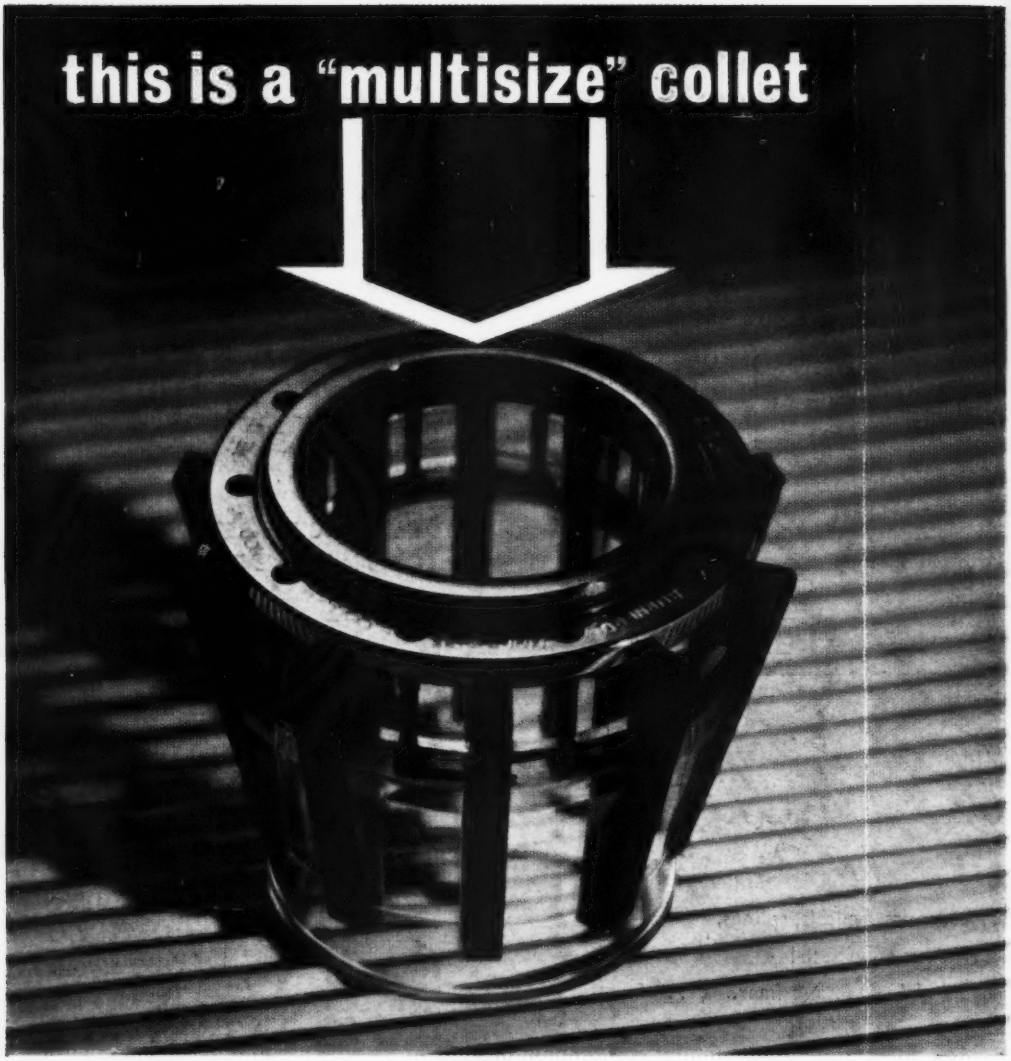

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